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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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Fundamental Conflict

COMMENTING on our exclusive description and discussion of the Elliott automatic landing system for the VC10 (issue of October 7) we wrote: "Readers may derive some warmth from the assurance that in the practical application of automatic landing this country is not only leading, but guiding, the world."

We are gratified to find that the relevant articles have been received by the world's flight-safety and electronic experts as major contributions to the literature of their professions. Especially has this been so in America, and an interview by a specialist member of *Flight's* staff with Boeing's staff engineer, electro-dynamics (page 840), contains news and views of notable significance.

The most remarkable finding is that present Boeing philosophy is "in fundamental conflict" with British thinking. Thus our assurance that Britain is guiding as well as leading is at present open to challenge. Moreover, the interviewer concludes that our lead is threatened with every passing month, and practical demonstration of our systems will be indispensable in convincing US companies and authorities that we have taken the right course.

Bicycles and the Board

THE story goes that a British independent airline, in order to evade a decree that it could carry passengers provided they were cyclists accompanied by their machines, ferried back and forth along the route concerned a token set of bicycles. Accompanying them were non-cyclists who, in the eyes of those who uttered this decree, were being diverted from the established BEA services.

We could cite other examples of how the independents—and the corporations—have evaded other negatively restrictive regulations of this kind. Let us hope that the policies of the nation's new Air Transport Licensing Board, due to hold court for the first time on January 1, will be more positive and progressive. Unfortunately, habit dies hard. In the correspondence columns of *The Times* recently Mr Anthony Milward, chief executive of BEA, felt obliged to answer criticisms that the demand for domestic services to Scotland was greater than supply. One of his critics, somebody evidently close to the independents, wrote: *"Perhaps the new Air Transport Licensing Board will be bold enough to permit other operators to fly services in parallel with BEA, provided they make an intermediate landing. Liverpool, Leeds and Newcastle are all possible stops on the Scottish routes. BEA would be fully protected as no traveller would use the stopping service unless the direct flights were full."*

The suggestion, it seems, is that the new board should be *bold* enough to issue this sort of licence. Our hope is that it will not be so timorous, nor indeed so half-baked. Just as ABC Airways carried its token fleet of bicycles, might not XYZ Airways, if it were licensed to operate London - Glasgow with a mandatory stop at Newcastle, try to get away with token touch-and-go landings at Newcastle? Our example is frivolous; but it serves to make the point that the more restrictive the legislation the greater will be the subterfuges devised to evade it.

The point, surely, is that if XYZ Airways wants to operate a London - Glasgow service in competition with BEA, a licence must be issued or withheld by a board capable of making positive, and not negative, compromises. And it can do this only by making a thorough and penetrating analysis of the economic and public-interest issues involved. Our new board must not be just a tribunal of wise men listening to partisan pros and cons. It must have the backing of a competent staff capable of examining for itself, *independently*, the issues involved.

FROM ALL QUARTERS

Lord Brabazon's Fuel Duel

THERE is no doubt that Lord Brabazon's contribution to the BBC Television programme, *Panorama*, last Monday evening will have fanned the flames of the kerosine-JP.4 controversy more than anything so far printed on the subject. Lord Barbazon said, in front of eight million viewers—after an outdoor-filmed demonstration of the relative inflammability of the two fuels—that "whenever people buy a ticket they must ask at the airline booking office whether they are to be flown on paraffin or petrol."

It was explained by the BBC that Lord Barbazon feels so strongly about the superior safety of paraffin *versus* the gasoline-based fuel—to which jet operators are now switching because it is cheaper—that he had challenged the users of JP.4 to a contest. [Lord Brabazon made this challenge in *Flight* for October 7, page 595.]

Had there been any takers? "Certainly not," declared Lord Brabazon, "and in a moment you will see why." Viewers then saw Mr John Rickard, a *Flight* contributor on this topic, attempting to light a large pool of spilt paraffin with a "very hot" blowlamp. Two half-minute applications of the blowlamp did not produce ignition, and the rag that Mr Rickard threw on the pool did not cause ignition for some time.

The JP.4 appeared to ignite immediately Mr Rickard applied a light. "That is only eight gallons," said Lord Brabazon, "and when a 707 takes off there would be 10,000 gallons on board" [nearer 20,000—Ed.]. He named two American international airlines, one Belgian and one Canadian airline as users of JP.4. He emphasized that neither BEA nor BOAC use JP.4.

Viscount Stansgate

A FORMER Secretary of State for Air (1945-46) and a pilot in the RNAS and RFC, winning both the DSO and the DFC in the First World War, Viscount Stansgate died on Thursday of last week at the age of 83.

As Mr William Wedgwood Benn, he sat in the House of Commons as a Liberal and subsequently as a Labour MP. In the Second World War he served in the RAF, being mentioned in despatches; and from 1942 to 1944 he was Director of Public Relations at Air Ministry. He was created a viscount in January 1941.

North-South Buy the Herald

THIS week North-South Airlines, of Yeadon Airport, Leeds/Bradford, were concluding with Handley Page the purchase of a Dart Herald for delivery next April. A further aircraft may be chartered from the manufacturers for the 1961 summer season and a second may be ordered for delivery in 1962.

At present North-South operate a Heron leased from Overseas Air Transport on domestic scheduled and charter services, but they have applied to extend their network from January 1 next year to include Copenhagen, Le Bourget and Albenga on the Italian Riviera. All these services would be operated by the 44-seat Herald, but its purchase does not depend upon these licences being granted.

Jack Overbury

IT is with regret that we record that Lt Cdr J. R. S. Overbury lost his life on Wednesday of last week in an accident to a Jet Provost which he was test flying.

Jack Overbury joined Hunting Aircraft from Saunders Roe Ltd, where as chief test pilot he had concluded the SR.53 prototype trials, in March last year. In 1954 he was awarded the de Havilland Trophy for a point-to-point London - Amsterdam record (at 571.5 m.p.h.) he set up in a Sea Hawk; and in 1955 he established a Rome - Malta record in a Sea Venom at a speed of 538 m.p.h. He had a serious accident at Sandown, IoW, in 1958 while demonstrating a Druine Turbulent. His injuries necessitated four operations and he was grounded for several months, only his determination to fly again bringing him back into the test pilot's profession.

ROYAL RECIPIENT of a history of the Central Flying School: Queen Elizabeth the Queen Mother, Commandant-in-Chief of the CFS, being presented with a bound volume by the Commandant, Air Cdre J. N. H. Whitworth, during her visit to RAF Little Rissington on Wednesday of last week. Behind Her Majesty is the AOC-in-C Flying Training Command, Air Marshal Sir Hugh Constantine. This was the Queen Mother's first CFS visit since she became Commandant-in-Chief last July

BARON is the name of the newest Beechcraft for 1961. Powered by two 260 h.p. Continentals, it carries five persons plus luggage at 216 m.p.h. Basic price is $58,250, and gross weight is 4,880lb

Starting by Steam

STEAM, it would appear, is not the outmoded power-source suggested by current use of the word in such contexts as "steam radio." We have the steam catapult, and now comes the steam starter—from, surprisingly at first glance, Associated Electrical Industries.

They have developed an aircraft ground starter operating on the simple principle of utilizing a flash evaporator to generate steam at pressures and temperatures comparable with those currently used in low-pressure air starting systems. Existing air-starter turbines and hoses, it is stated, can be used with the AEI equipment.

The steam plant, with fuel and water tanks, is mounted on a Land-Rover, the engine of which drives the water pump for the evaporator and fuel pumps and an air blower for the burner, which uses wide-cut gasoline. The vehicle, states the company, carries sufficient fuel for 50 starts at a cost of 1s 6d a start. Output can be adjusted to match different engine requirements, and a typical starting time of 15sec is quoted. No power need be drawn from the aircraft electrical system when starting is under the control of a ground operator.

The equipment is not yet in production, but operational data already obtained during the development period are available from the Aircraft Equipment Sales Division of AEI at Raglan Street, Coventry.

Improving the 707

FURTHER details of the new Boeing 707 variants were gathered during a *Flight* staff member's visit to Seattle. The fan-engine versions now flying as the 120B (a modified 120 of American Airlines) and the first 720B have accumulated more than 230hr of FAA flight-testing time and have shown improvements in fuel consumption over their straight-jet counterparts of between 20 and 25 per cent. This is partly due to the efficient cowling, which Boeing themselves produce. There is no suppressor, but both fan and main effluxes can be reversed. Intake noise is considerable, but a "hush kit" is being developed which will rearrange the intake guide vanes.

Fan engines have made the 720B a "medium transatlantic" aircraft, and their increased power and economy are now to be applied to the Intercontinental variants. This will result first in the 320B, which could be delivered in 1962. It will have new leading-edge flaps, slotted fillet flaps and slots in the present main flaps, raising the peak C_L to about 2.3 (the 720 reaches 2.0). Range will be 4,600 n.m. with reserves, allowing non-stop London to San Francisco operation with 29,000lb payload from a 10,170ft runway (which should be available by 1962). The return flight could be made with 35,300lb from a 9,900ft runway. Idlewild-Moscow could be run non-stop with 37,000lb. High-speed cruise would be M0.85 (510kt TAS) with the ability to fly at M0.87 at the cost of 1,800 miles range. Powerplants will be P & W JT3D-3s, giving 18,000lb dry and with water injection to restore power at height.

***NEW DIRECTOR-GENERAL** of Aircraft Production at the Ministry of Aviation: Mr L. R. Beesly, who takes up his new duties on December 1. Since last year, he has been Superintendent of the Royal Small Arms Factory at Enfield. Prior to that he was Director of Engine Production at the Royal Ordnance Factory, Dalmuir*

A 320B freighter would have an 80,000 to 90,000lb capacity at 10 or 11lb/cu ft at a gross weight of 315,000lb. A mechanical loading system would form part of the quoted empty weight. A swing tail, with its 2,000lb penalty, is considered mainly a military requirement (the so-called 735 project).

The 520B will be powered by JT3D-5s giving "over 20,000lb" thrust, and will have a 140in fuselage stretch, and a gloved wing for extra fuel capacity rather than high-speed performance. Improved high-lift devices, and blowing over certain portions of the flaps, will allow a C_L of 2.4. Gross weight will be about 400,000lb, and the type will have non-stop capability from London to most capitals except Canberra. Advanced Rolls-Royce Conways (stage 7s?) will be alternative powerplants.

News from Lockheed

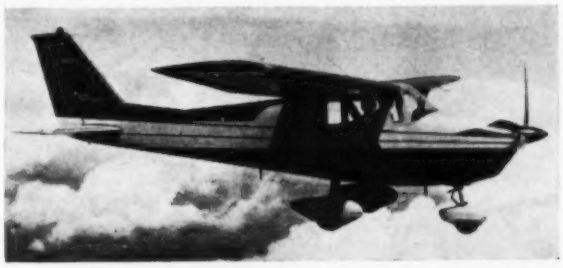
VERY quietly, Lockheed Aircraft Corp recently took the unprecedented step of writing down their net assets in order to write off the heavy outlay which they have made to support their current programmes. The amount involved was $67,569,000, which resulted in an apparent net loss for the first half of 1960 of $55.4m. The largest single item accounted for was approximately $31m to cover development of the Jetstar and possible production losses on this aircraft. The second largest sum was $24m for engineering development and modification of the Electra. The company feared a premature "leak," coupled with news of the $55.4m loss; but all that actually happened was that the company's stock dipped slightly and then rose above its previous level and stayed there. Following are notes on current programmes:—

Electra. All but 20 of the 162 Electras ordered have been completed, and further sales appear doubtful in view of the unfortunate accidents stemming from engine/gearbox decoupling and subsequent wing failure. Last week it was announced by Braniff International Airways that, following the loss with 34 lives of one of their Electras in September 1959, proceedings were being taken against both Lockheed and the Allison Division of General Motors alleging "gross negligence" (see page 852).

P3V. The P3V-1 is a completely re-engineered Electra being developed as the standard shore-based ASW aircraft of the US Navy. Following intensive trials with an aerodynamic prototype, manufacture of production aircraft is in hand. The first should fly in March; the second, due for completion in January, will be a static-test aircraft. Total funding was recently increased (by $52.4m) to $125.7m, although the number of production machines involved is still small.

Hercules. The backlog on these military transports has recently risen to $181m, partly owing to a repeat order for 30 GV-1 tankers for the US Marine Corps. The Military Air Transport Service are shortly to place an order for 14 (to be followed by a further 36) of an extended-range version designated C-130E. Equipped with pylon tanks, the E is the first Hercules bought by MATS, and is an interim machine only.

Jetstar. Development of this 550 m.p.h. light transport is nearing completion. Total orders at present amount to 25 for business houses and 4, designated C-140, as electronics vehicles for the Airways and Air Communications Service (an arm of MATS). Owing to the writing-down already noted, the 30th—and subsequent—aircraft will be profitable.



***WICHITA TRIO:** The 1961 Cessna range includes (from the top) the Model 185 Skywagon six-seater (260 h.p. Continental), Skyhawk prestige version of the Model 172 four-seater (145 h.p. Continental), and the Model 310F five-seater (two 260 h.p. Continentals)*

IN BRIEF

The search for wreckage of the Victor B.2 which went into the sea off the Pembrokeshire coast in August last year on a test flight from Boscombe Down ended last Saturday. Dr P. Walker of RAE Farnborough said they were "reasonably satisfied" they had the answer to the crash.

Air Marshal S. Mukerjee, Chief of the Indian Air Staff, who died suddenly in Tokyo on November 9 soon after his arrival from New Delhi on a visit to Japan, was 49 and the first Indian to command the air forces of his country, having become Commander-in-Chief in 1954. He trained at Cranwell and served in the RAF before returning to India.

Answering a question about what British aircraft had been offered to the West German Government to replace the Sea Hawk and Gannet, the Minister of Defence (Mr Harold Watkinson) said in Parliament last week that the Federal German Government had been given full information on the Sea Vixen, Scimitar and Buccaneer and also about the characteristics and performance of all British helicopters.

When he arrived in Sydney on November 18, Lord Caldecote, executive director for guided weapons of British Aircraft Corporation, said that BAC would set up "a strong local organization" in Australasia. It is not yet possible to detail the form which this will take, but at present the three chief members of BAC all have their own agents or Australian companies, as well as the non-aeronautical giants of Vickers Ltd and the English Electric Group.

The Royal Swedish Air Board announced in Stockholm on November 17 that an agreement had been reached with Raytheon for the supply to Sweden of Hawk missiles. Hawk is an air-portable semi-active CW system capable of destroying targets at tree-top height. It is in limited use by the US Army, but has been adopted as a standard NATO weapon. It is not known to what extent this decision affects Sweden's adoption of Bloodhound 2, Bloodhound 1 already being in limited service.

Continental piston-engines built under licence by Rolls-Royce Ltd (*Flight*, November 4) are to be made in the company's Crewe works.

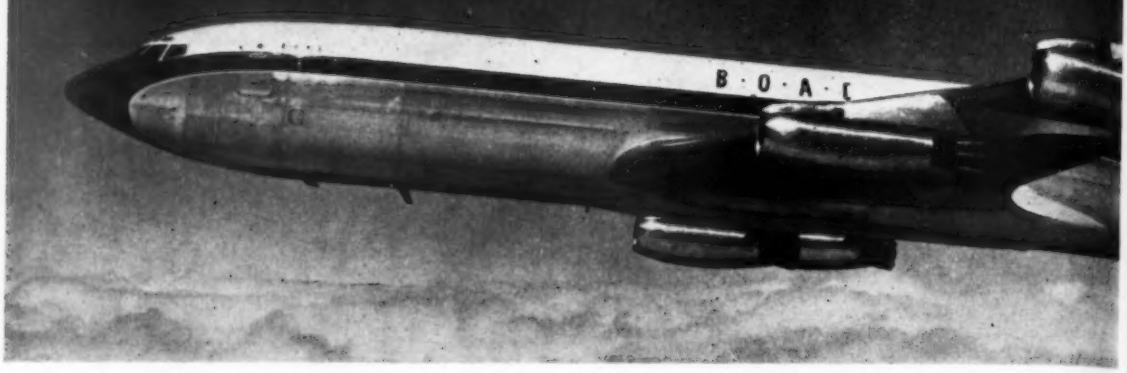
Two air-to-air photographs by Mr Russell Adams, chief photographer of the Gloster Aircraft Co Ltd, showing the Jet Provost team of the RAF Central Flying School, are included in the Industrial Photographic and Television Exhibition at the Royal Albert Hall, London, ending today.

Mr A. J. Wallis, formerly group public relations officer for Hawker Siddeley, is now handling PR in the United Kingdom for Lockheed Aircraft Corp and Lear Inc, as a director and general manager of H. William Bernhardt Ltd. Co-director is Cdr Michael Parker CVO RN(Retd), who represents Lockheed in the UK.

Enoch Thulin Bronze Medals of the Swedish Society of Aeronautics were recently awarded to Dr S. G. Hooker, technical director (aero) of Bristol Siddeley Engines Ltd; Dr R. R. Jamison, assistant chief engineer and head of the ramjet department of Bristol Siddeley; and Mr A. A. Lombard, director of engineering, aero-engine division, Rolls-Royce Ltd.

The Swedish aircraft and car company, Svenska Aeroplan Aktiebolaget (Saab) have formed a British subsidiary, Saab (Gt Britain) Ltd, to handle their aircraft, electronic and car interests in the United Kingdom. Directors are Mr Tryggve Holm (chairman), Mr A. R. Moore (managing director) and Mr G. R. Alford.

The index to Vol 77 (January-June 1960) of *Flight* is now available, price 1s (by post 1s 3d), from Iliffe & Sons Ltd, Dorset House, Stamford Street, London SE1. Readers' copies of this volume can be bound (with index) at a cost of 25s, return postage included; or binding case and index are available separately, price 7s 6d (by post 9s). Copies for binding (with sender's name and address enclosed) should be forwarded to Iliffe & Sons Ltd, Binding Dept, 4/4a Iliffe Yard, London SE17, and advice and remittance sent separately to the publishing department at Dorset House.



JET SPEEDBIRD WEST AND EAST

With BOAC to Seattle and Back

BY MARK LAMBERT

ONE lesson I learned from a recent double crossing of the Atlantic and the US is that pure navigation and cruise control are increasingly subordinated to traffic control, in respect of both tracks and heights. The aids are relatively poor and old-fashioned, though they work well in good conditions, and the competition for the best height or track is so fierce that it takes a cunning captain to operate his aircraft as the designers intended. He needs something of the craftiness and skill of the old tea clipper captains.

For me it all started rather suddenly when I managed to join a BOAC Boeing 707 proving flight via New York to Hong Kong, drop off at San Francisco, fly in a United Boeing 720 to Seattle and come home non-stop past the Pole on BOAC's 13th 707-420. An Atlantic crossing consists of an airways departure and arrival bracketing a classically navigated over-water flight. ATC separations, based on expected navigation accuracy, require 120 miles lateral, 30min longitudinal and 2,000ft vertical separations between airliners. You fly even flight-levels to Shannon, odds westwards over the water (evens eastwards) and the best height available into New York. The shortest distance is the Great Circle, but you may plot a rhumb line to the south or a Polar curve to the north, mainly to take you through more favourable winds circulating round lows or highs. Jet airliners do not fly classical pressure patterns, but the three routes allow a degree of pressure flying. BOAC deviate from the Great Circle only if they can forecast a time gain of better than 15min. Because of ATC limitations, the cruise technique for the 707 is to fly at near M0.81 at about 93 per cent r.p.m. and at constant height, hoping for the best height but having to accept what ATC allows. As the aircraft gets lighter, speed increases and at M0.82 r.p.m. are reduced to drop speed back to M0.81. This process is repeated as required.

The flight-planned track is made out for successive beacons and then for "lat and long" positions, reporting every 10° of longitude by HF/RT to the appropriate centre—Prestwick, Reykjavik or Gander. The navigator makes a DR plot on a 1:6,250,000 chart overprinted with Loran lattices and Consol count lines as well as the main beacons. He can use Loran and Consol, astro, weather radar, NDBs on weather ships or at other —often surprisingly remote—locations.

We took off from London weighing 134,600kg with a 42sec ground run, planning Green One to Shannon and thence by Polar Curve at 33,000ft north of weather ships Charlie and Juliet, south of Bravo and to Goose. This avoided some rather aggressive lows. After Goose we joined the air routes and plunged into the New York maelstrom. I tend to doff my hat respectfully when people mention New York now. We estimated 535 m.p.h. in ISA+8°C, a 7hr flight leaving Ireland at 13.20Z (GMT), mid-water at 1500Z, Goose at 1705 and passing Montreal at 1840. England and Ireland slipped away in the rock-steady rumble of the 707. Over the water, high-level sheets and veils of cloud scissored in perspective over mattresses of thicker stuff lower down. There was the odd cloud street or ridge and I had the impression of an underwater landscape floodlit.

The 707 is intended to be flown under autopilot control (Bendix PB-20) between take-off and landing. The pilots are no less busy when the autopilot is engaged than the driver of a car with an automatic transmission.

Flight level 370 was taken by the military on this day (it often is) and the temperatures were too high to allow us to get through to 390, even if ATC cleared it, so we stayed at 330. You would think that every jet airliner tried for one ideal track at the same time, but ATC get over this by designating Lundy, South Shannon, Bush Mills and Prestwick as starting points for the track, with equivalent points on the other side. You could also plot a composite track, usually made up of two legs each of one of the three basic types. BOAC have the Edo Loran and, with the aerial high up in the new fin it gives good results unless the northern lights or static play it up.

The trick is to arrive at the Canadian Air Defence Identification Zone reporting point within 10 miles laterally or 5min longitudinally. Otherwise they file a violation, which means real trouble. A plain Loran fix can be obtained in 2min and a fix compensated for aircraft progress in 3min to an accuracy of two or three miles in good conditions. In bad, it may be 20 miles. The CADIZ entry is usually made from a series of fixes along a run-up track to a point about 150 miles from the Canadian coast. VOR can come in at about 200 miles and weather radar will identify a landfall at about 100 miles. Where accuracy is important, the aids seem to be reasonably abundant.

At 1630 we were approaching land, radar showed a faint blur at 100 miles and VOR was beginning to come in. By 1650 we were talking to Goose on VHF, the radar was off and we were getting the air route clearance into New York. The home stretch was starting. The instruments showed M0.82 with 88 per cent r.p.m. we had been cleared to flight level 350 with −52°C and could now have made the step to 390.

By 1735 we are over the lake-pitted Canadian wilds and have the wide St Lawrence in view far on our left through breaking sheet cloud. We are past Goose and climbing an ADF ladder past Lake Eon and Seven Islands NDBs, along the St Lawrence to Mont Joli and Montmorency NDBs at Quebec. We are getting airways clearances and things are warming up, with a good deal of radio tuning and consultation of charts and manuals. At 1830 we have been flying for 6hr 4min. We are cleared along the high level Jet 75 Victor across Plattsburg VOR to Albany VOR. Here we descend from 350 into Victor 91 at 250. All this has been received and written down by the co-pilot. The let-down involves throttling the outboard engines to 50 per cent and the inners to 68 per cent, the engineer working throttles and cabin pressure controls together to avoid "bumps." Descent is at 290kt and 2,500ft/min. We have radar advisory service, but they lose contact briefly about here. Capt Nisbet, 707 Fleet manager, has now disengaged the autopilot and is flying manually.

Then it comes thick and fast with successive hold height and descend instructions. Albany VOR to Poughkeepsie range to Wilton VOR, to Syosset (intersection of Idlewild and Wilton radials), to Hempstead range, out along its south-west leg to Lido NDB and round to Ambrose (intersection of Idlewild and Colts Neck radials); and all the time stepping down in height, reading checks, tuning radios, reading charts and using VHF to receive and check instructions and be told by radar of loss of other traffic. The clearance is somewhat changed as we progress.

We pass Wilton at 15,000ft, Hempstead and Lido at 8,000, Ambrose at 3,000 and put down 20° and then 30° flap and gear and slow up to 180kt. Cleared to ILS for Idlewild 04 runway;

In the heading picture is a BOAC Boeing 707, the type in which most of the journey here described was made. It is a powerful and efficient aeroplane, greatly liked by its crews

cleared direct to outer marker; cleared to leave marker to port at 1,000ft, cleared to circle round left-handed for our designated landing on 31R and finally down with a roar of reverse thrust. Landing weight, 88,000 kg; cross the hedge at between 130 and 140kt. A fine piece of hand-flying and snappy team-work—and the distance from Wilton to touchdown is probably less than 60 miles.

We made the New York to San Francisco crossing next day in 5.45hr. Take-off 42sec at 136,600kg gross, cruising at 31,000ft on air routes all the way. The writer shamefully asleep in a reclining first-class seat. "Frisco" to Seattle was made next morning by United Boeing 720. Take-off weight, 187,000lb (United use pounds); ground-run 32sec; V_R 122kt; V_2 137kt is reached at 35ft. A Convairliner landed parallel 200yd away as we took off. We cruised at M0.83 at 28,000ft; estimated flight time 1½hr. Loitered round Mount Rainier (14,000ft plus) at 28,000ft while fog lifted from Seattle Tacoma. Emerged from cloud close to the top of a crane jib and made perfect landing. The 720 is as fine an airliner as the 707.

Home Past the Pole

The flight home was in the thirteenth of BOAC's Boeing 707s, non-stop over Canada, Hudson's Bay, Baffin Island, Greenland, past Iceland and over Northern Ireland—airways to Carmi, just inside Canada, direct to Frobisher, great circle to Bush Mills and airways to London. The crew: Capt "Dexter" Field (who did much of the acceptance flying on this and previous 707s), 1st Offr Jack Butt and 1st Offr John "Skate" Lee as co-pilots, Nav Offr "Danny" Kaye, Engr Offr D. Donaldson, Engr Offr H. Breslin, and Ch Stwrd S. W. Hemming. The last named was required even on this ferry flight for certain emergency drills, but also acted as a most welcome supplier of tea, coffee, food, etc.

Our take-off weight was 130,500kg, of which 72,000kg represented full tanks. We needed, with all allowances, 66,500kg of fuel for the 4,210 n.m. flight. Estimated flight time 8hr 42min on a minimum-time track, with average +24kt wind component, calculated by BOAC's New York dispatching office and received in Seattle by telephone. The 72,000kg of fuel would give us 11hr 48min endurance. Track: Carmi, Churchill, Frobisher, 64°N at 50°W, 56°N at 10°W, Bush Mills, London. Flight level 330 to 90°W, 370 to 20°W, then 410. Take-off about 1700hr local, 0100Z (GMT).

Take-off clearance: "Climb on runway heading to 3,000ft: left turn to heading 340° to intercept 030° radial of Seattle VOR: climb NE-bound until 15,000ft via direct Carmi: maintain flight level 330. Transition height, 24,500ft because of the mountains. Gets dark during climb, red rotating beacons reflecting off pods; flight deck almost Christmas-like in red and white lights on grey panels: everyone head-down working hard, except pilots peering into night sky. We press on to cruising height, mostly using DR plot and scattered NDBs with occasional VOR.

Talking to all sorts of stations on VHF and HF, asking for position reports to be passed to BOAC at Montreal. Distinctly Canadian accents on radio.

Change heading from 025° to 060°. Meet jarring turbulence: navigator's plot shows sharp wind-change: radar shows thunderstorms: temperature drops rapidly; lights dimmed and captain stares into black night, hand on autopilot heading control. This is a jet stream—and rough! Decide to climb straight to 370 to get clear, and notify control. Using both VHF and HF almost constantly. Pass Tippo Lake at 0202Z estimating Churchill at 0300Z. Dull, furtive veils of northern lights snaking above us—

plays hell with the radios. See ice or snow through gap in clouds.

0230Z: Sextant aperture frozen tight, so no astro. Not in Loran cover yet and probably blacked out when we get there. We are told that Churchill is due to launch some rocket at our exact ETA overhead! Search manuals, find their HF frequency, ask them to desist, but fortunately the firing is delayed anyway.

0315Z: Past Churchill at 37,000ft, M0.82, ETA Frobisher 0435Z. Loran switched on but not performing yet. Magnetic variation nil at Churchill, but builds up at 1°/min to 54° in the 700 miles to Frobisher. Using Polar Path gyro on DG. 0337Z: Just getting one Loran line over Hudson's Bay. 0430Z: 480kt TAS, heading 030°. Weather radar mapping, Loran on, both

Capt Nisbet, flight manager of the 707 fleet, at the controls with the third pilot on the jump seat behind him. This picture was taken over Canada, before the air-route approach to New York became busy. The instruments show M0.82 at flight level 350

"Flight" photograph

ADFs tuned to Frobisher NDB, no astro. Outside air temperature—52°C. Hear SAS over-the-Pole flight asking to climb from 280 to 310 at 0449Z, position 70°W, 66°N. KLM flight is there too. Northern lights seem to have gone. We talk to "Leeway" on VHF. 0445Z: Note from co-pilot Lee, "Leeway is defence radar at Frobisher: we saw their lights on the ground: have now returned to compass steering: will get radar fix on No 2 VHF at about 0455Z: now reporting to Goose on No 1 HF." Our report, read from a form, gives estimate for 64°N, 67°W as 0509Z, the wind found, fuel state and consumption, speed, ETA for London and much besides. Goose asked to repeat to Gandar and Montreal for BOAC, to Sondrestrom for ATC. Sondrestrom cannot understand, so Goose changes HF frequency to try again. "Leewey" fixes us by radar at 120 miles. SAS and two other BOAC aircraft talking on HF. Navigator plotting all the time; engineer fills in fuel tables every 5,000kg, about every 40min. Pressurizing on one turbocompressor and two direct engine bleeds. We call Prestwick on HF, apparently without reply.

0530Z: Northern lights sneak up again. ADF tuned to Kook Island NDB, mid-west of Greenland, and we see its lights below. Whoever lives there? No 2 ADF getting Christiansund NDB, 320 miles away on southern tip of Greenland. At 37,000ft: TAS 475kt; two minutes up on ETA; winds northerly; engines at 88 per cent r.p.m.; radar tilted down 7° for mapping.

0542Z: Temperature −55°C. Air has been smooth for hours. Captain and navigator still hard at it, co-pilots and engineer relieved. Passenger cabin a dark, empty tunnel—only nine seats fitted. Dead of night, northern lights stealing about.

0625Z: At 35°W and 37,000ft. Hope to climb at 30°W. Three min ahead of plan. No VHF contacts. Iceland cannot hear our HF, so relaying via Sondrestrom. Expect to contact weather ship on VHF at 0645 and get fix. Nearest to Iceland at 0700. Many other aircraft south of us calling Gander. Receive HF weather broadcast from Shannon giving shallow fog for most British airfields; also Canadian maritime weather broadcast from Gander. Frobisher has a 9,000ft runway good for a diversion. Our point of no return relates to Gander. But now we have the feel of the other side and are heading south-east for Britain.

0800Z: Wake with a start from sleep to see a hard yellow, copper and pale green dawn rising over us. Still making 480kt true on 132°. ATC has held us down to 37,000ft; passing 10°W and estimating Bush Mills at 0830Z. Windscreen frames now thickly coated with frost. The sun begins to shine dazzlingly straight in at the windscreen, and shades are down, lights turned low. Outside temperature −48°C. Captain still in seat.

Navigator makes complete table of airways check-point ETAs for Red 1 and Amber 1 via Belfast, Isle of Man, Wallasey, Lichfield, Daventry, Beacon Hill and Watford to LAP's runway 28R.

(*Concluded on page 853*)

***THE BOAC** team on the flight line at Seattle with the fourteenth and fifteenth BOAC 707s. Second from the right is Ivor Lusty, chief BOAC representative there, with Mark Lambert next to him in the centre*

Missiles and Spaceflight

MOUNT KENYA LAUNCH-SITE PROPOSED

A multi-phase plan for a British space-research programme was put forward by Mr E. G. D. Andrews, chief designer (rockets), Bristol Siddeley Engines, in a lecture before the British Interplanetary Society on Saturday last, November 19. In his paper, *British Participation in Space Research*, Mr Andrews gave estimates of the probable costs involved, an appraisal of the British Commonwealth's resources in this field, and a study of the various types of possible launch vehicles.

The launch vehicles, depicted in the illustration on this page, were described by the speaker as follows: "Let us say that stages propelled by liquid oxygen/liquid hydrogen are OH; liquid oxygen/kerosine, OK; and hydrogen peroxide/kerosine, PK. The size of the stage may be indicated by the position it would have in the launcher, and since the top stage is the same size in all phases, call this 1. Then Blue Streak is OK3, the modified Black Knight is PK2 and so on.

"This first phase proposed consists of OK3, PK2 and PK1. Mr E. C. Cornford has already outlined its potential in some detail; he says that it should be capable of placing a payload of 1,800lb in a precision orbit at an altitude of 300 miles, or of placing a payload of up to 200lb in a highly eccentric orbit with an apogee of 100,000 miles. By the same token it could give escape velocity to a payload of nearly 50lb.

"The second phase would involve no more than the replacement of PK1 by a new stage OH1. This would make little difference to the close Earth orbit, the payload rising to just over one ton. For the orbit with 100,000-mile apogee, however, the orbital weight would be more than doubled, that is, the payload would be multiplied by a factor of three or four, even allowing for the greater specific weight of liquid hydrogen tanks. Escape velocity could be given to a payload of about 250lb.

"These figures disguise a very important feature of this phase, which is that there are now two vehicles capable of launching satellites. Placed on top of a standard Black Knight and launched from the Black Knight launcher pad, this top stage could carry a payload of about 100lb into the 300-mile orbit. This is admittedly marginal, but it provides an economic means of launching small scientific instruments. . . .

"It is the third phase, however, which introduces the really exciting possibilities. This is the replacement of PK2 by a new stage OH2. With a top stage, the payload in the 300-mile orbit would be about three tons, which should be sufficient for experiments leading up to manned re-entry. The payload in the orbit with 100,000-mile apogee would be about ½ ton, and escape velocity could be given to a load of several hundred pounds.

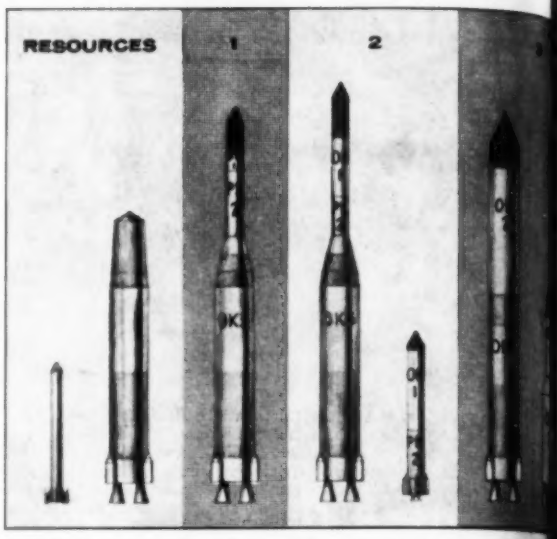
"If the payload were provided with the propulsion unit of PK1 to retard it, soft landing of perhaps 200lb of instruments could be made on the Moon.

"Even more exciting is the fact that stages OK3 and OH2 by themselves would be capable of placing one ton in orbit at an altitude of 300 miles, which means that a space station 10ft in diameter and over 40ft long—stage OH2, in fact—could be placed in an orbit where it would remain for several years."

On the question of costs, Mr Andrews assumed £1m to £2m for the conversion of Black Knight for use in the first phase. The additional development cost for Blue Streak, assuming that two-thirds of the amount spent already was relevant to the satellite launching programme, might be £32m. Allowing as much for the top stage as was originally required for Black Knight, the total development cost of Phase 1 would come to approximately £38m.

Even after the first successful firings, development costs would presumably continue. One could suppose that in the subsequent year they would be half the maximum rate, the next year one-third, and so on. The unit costs of vehicles launched might cost anything from £20 to £50 per pound of fixed weight—a range of about £300,000 to £700,000. Including the launching costs, a round figure of £1m was suggested.

On this basis, Mr Andrews stated, Britain could launch a dozen payloads (a total of about ten tons) into 300-mile orbits in the next six years for an additional cost in the region of £70m. "Allowing in Phase 2 for the re-engining of the top stage, providing additional launching facilities for the small satellite launcher and for the alternative versions of the two stages, a development cost of £10m would be, if anything, excessive. Without exceeding an overall expenditure of £14m a year, therefore, the first flight of this new launcher vehicle could, if desired, take place toward the end of 1966."



Possible first three phases of a British space-research programme, as outlined by E. G. D. Andrews in the BIS paper reported on this page. Using Black Knight and Blue Streak as existing resources, the succeeding phases are: 1, three-stage vehicle comprising Blue Streak, Black Knight and a hydrogen peroxide/kerosine stage; 2, three-stage vehicle with new liquid oxygen/liquid hydrogen third stage, and two-stage vehicle omitting Blue Streak; 3, two two-stage vehicles, Blue Streak plus new liquid oxygen/liquid hydrogen upper stage, and this latter stage plus Phase 2 final stage

The speaker's third phase would be more expensive—£20m would be a rough estimate. Even allowing for the additional expense of developing a manned capsule, manned re-entry would be possible for Britain early in the 1970s without exceeding the overall expenditure of £14m a year. "In other words, for £140m Britain could be on the threshold of manned exploration of space, having launched in the meantime perhaps the equivalent of 25-30 tons in the 300-mile orbit."

Mr Andrews considered three potential launching sites within the Commonwealth—Spadeadam Waste, Woomera, and a possible site on the top of Mount Kenya, of which he said: "Situated on the equator and rising to a height of over 17,000ft, this dormant volcano seems to be the ideal launching site for interplanetary probes and other difficult launchings. The Indian Ocean lies some 380 miles to the east of it and beyond that lie a number of islands under Commonwealth control and suitable for tracking stations. Singapore is directly in line some 4,000 miles away."

The following five factors, the speaker suggested, made such a site preferable to that at Woomera.

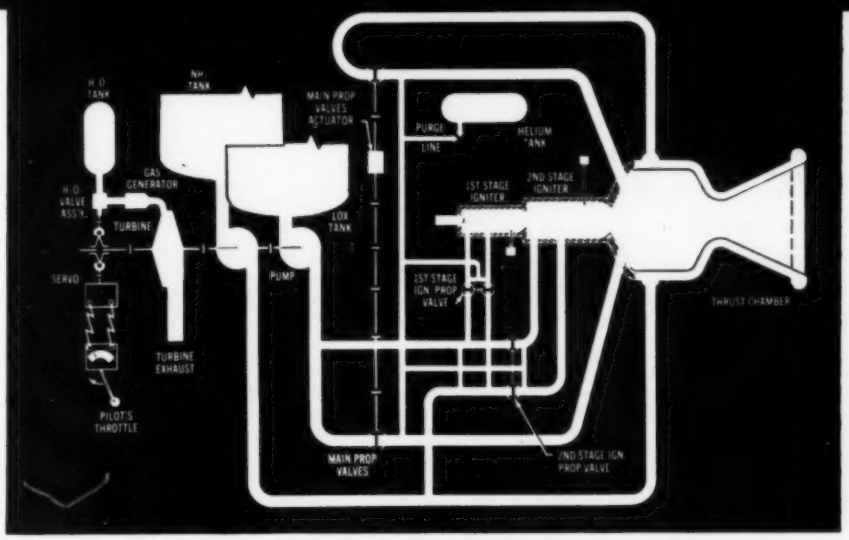
(1) An equatorial trajectory makes it easier to place satellites into orbit in the plane of the ecliptic; and the easterly launch makes it possible to launch "stationary" satellites efficiently. (2) An equatorial launch provides the maximum initial velocity (1,500ft/sec) for a vehicle launched in an easterly direction. (3) The low atmospheric pressure at 17,000ft causes the specific impulse of the rocket engine to be increased at launch by about six per cent. (4) The improvement in specific impulse enables an increased launch weight to be used without corresponding increase in engine weight, hence increasing the mass ratio of the vehicle by nearly the same amount. (5) The low density of the atmosphere results in lower aerodynamic drag during the initial phases of the launch.

"Compared with an equatorial sea level site, the gain could be worth about 1,500ft/sec. Although this does not sound very high it corresponds to an increase in payload of between 20 and 30 per cent, depending on the conditions. For the launch of a manned expedition to the Moon this could be worth £5m per shot. The only known technical disadvantage is that the launch trajectory passes through the deepest section of the Van Allen belt."

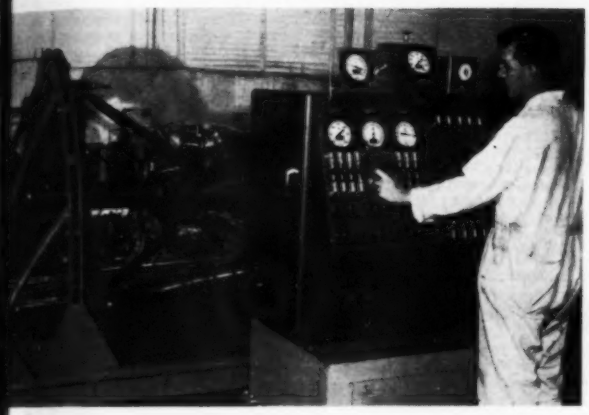
SPACE MEETING IN GENEVA

Government representatives from ten European countries are to meet in Geneva on November 28 for a four-day discussion on a possible programme for co-operative space research. Among the proposals to be considered is one for a European space-research centre. This development follows the recent London meeting of scientists from Switzerland, Britain, West Germany, Belgium, France, Italy, the Netherlands, Denmark, Sweden and Norway, and is not connected with the efforts of the Minister of Aviation towards a similar but larger-scale objective.

Missiles and Spaceflight . . .



A simplified schematic diagram of the XLR99, which has been given the name of Pioneer. Sea-level thrust can be varied up to a maximum of 57,000lb. It should be noted that the diagram makes use of the Americanisms "lox" for liquid oxygen and "prop" for propellant



Production XLR99s are finally checked out on a Thiokol-designed console, with which all operations can be simulated prior to hot firings

XLR99 FLIES AT LAST

ON November 15 the most powerful engine ever developed for an aeroplane flew for the first time. Designated XLR99-RM-1, it has been developed by the Reaction Motors Division of Thiokol Chemical Corp as the definitive powerplant of the North American X-15 hypersonic research aircraft. The X-15 was described in our issue of May 8, 1959; a detailed analysis of its earlier test flying, using the interim package consisting of two XLR11 four-barrel engines, developing a total of 16,000lb thrust at sea level, was in the issue of May 27, 1960. The new engine has a sea-level thrust variable up to 57,000lb.

Development of the XLR99 was formally started by the award of a prime contract to Reaction Motors in February 1956. Although completely new, and meeting specifications and requirements never before imposed on a rocket engine, the powerplant can trace its origin to work done by Reaction Motors during the Navy's Viking project. The vast amount of experience gained in developing engines for all but one of the rocket-powered research aircraft flown in the US also contributed.

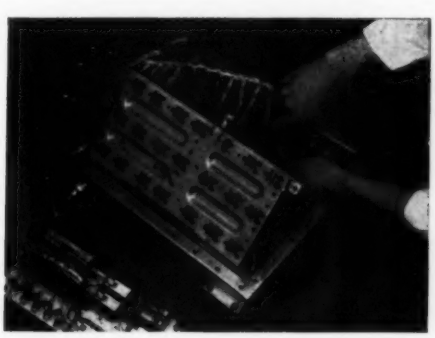
In 1954, when NASA (then NACA), the Air Force and Navy were developing the formal plans for a joint programme of piloted aeronautical research, Reaction Motors discussed the possibility of developing an aircraft engine based on experience and information gained in work done on a "Super-Viking" powerplant of 50,000lb thrust. Major differences existed between the requirements for this single-shot, remotely launched vehicle and an advanced piloted aircraft, differences mainly in throttling operations, airborne restarting, durability and—above all—safety. The engine is therefore not a revised or modified "Super-Viking" engine, but a new powerplant designed specifically for manned aircraft applications.

In the course of development of the XLR99, several major technological problems had to be solved. Durability of the engine, and the requirement for variable thrust, required major design and development effort on the thrust chamber. To enable the engine to be restarted in flight without the benefit of ground service equipment necessitated the evolution of a new igniter and ignition system. Thousands of individual tests on igniter operation have now been conducted, establishing its reliability.

Safety, probably the most significant factor in X-15 powerplant

The igniter (sectioned, right) is a two-stage device ignited by a spark plug and giving a continuous flame while burning the same propellant combination as the main chamber

The injector (left, below) is of the multi-spud type; the main thrust chamber is not only regeneratively cooled but is also coated (centre) with a heat-resistant ceramic; the main control box (right) initiates and transmits the signals which control both engine operation and safety functions



Missiles and Spaceflight . . .

operation, requires that the engine will operate and shut down without endangering the pilot, following any single malfunction. This necessitated controls, sensing devices and other equipment which would not only keep the pilot informed of the engine condition, but would automatically place the engine in a safe condition to prevent maloperation. During the testing of the XLR99, every conceivable malfunction has been artificially created in the engine system to assure complete reliability of the safety features.

Until December 1957, work on the engine proceeded as a conventional research and development programme. After the Russians launched Sputnik 1, greater emphasis was put on the programme. Additional parallel development efforts were initiated by Reaction Motors which resulted in the solution of many problems on an accelerated basis. Under these conditions, with delivery of the first XLR99 completed on March 26, 1960, work proceeded smoothly and on schedule until June 8, by which time the first engine had been installed in the third X-15 and fully instrumented for ground running at Edwards AFB. On that date a violent explosion occurred within the powerplant area, showing (if proof were needed) that the most painstaking attention to safety factors cannot eradicate catastrophe. The aircraft was so severely damaged that it is unlikely to fly again. Extensive studies have been made to determine whether a repair should be attempted, or whether an additional X-15 should be bought as a replacement.

While the flight envelope of the XLR11-powered aircraft was progressively being extended in both velocity and altitude (at the time of writing, to 2,196 m.p.h. and 136,000ft), another XLR99 was installed in the second aircraft. It was hoped that the engine would get into the air in October, but the first flight finally came on November 15. Owing to the relative newness of the powerplant, and its enormous increase in potential thrust, the flight profile was as modest as practicable. The pilot, Scott Crossfield, held the XLR99 to give minimum flight thrust (probably of the order of 20,000lb at height), and opened the speed brakes of the X-15. At a speed a little less than 2,000 m.p.h. he pulled the aircraft up into a climb and reached nearly 80,000ft. He landed back at Edwards eight minutes after release.

The XLR99 has a single basket-tube thrust chamber, rigidly mounted as a cantilever off the remainder of the powerplant. A turbopump driven by HTP feeds liquid oxygen and liquid ammonia at a maximum rate in excess of 12,000lb/min. During the starting sequence the propellant combination is passed through two igniter stages in series; the igniter is shown sectioned in one of the illustrations. As the circuit diagram reveals, the thrust chamber is cooled by ammonia, and after shut-down residual propellants are burnt off by continued igniter combustion and the pipes then purged by helium. The diagram also indicates the single power lever, connected through an electric servo and hydraulic governor. The full extent of the X-15 performance envelope cannot be calculated with a high degree of accuracy, but the XLR99 is hoped to result in speeds greater than 4,000 m.p.h. and altitudes which may reach 100 miles (528,000ft).

Douglas Aircraft announce the receipt of a $139,248 ARDC contract for project Slomar (Space Logistics, Maintenance and Rescue). It is a study of transport spacecraft to support men in orbit.

Hughes Aircraft have revealed something of their great work in advanced IR systems, with a description of a solid casting of germanium with a diameter of 15in and a thickness of 0.5in. Although completely opaque to visual wavelengths, the ultra-pure casting is perfectly transparent to a wide band of IR radiations. Valued at $6,000, the casting is regarded as a "picture window" for missile guidance and space surveillance systems, replacing the narrow portholes previously available.

Scheduled for completion at the end of next year is "the world's most advanced aerospace chamber," now being built at the Rye Canyon Research Center of Lockheed Aircraft. Virtually a sealed flask 10ft in diameter and 10ft high, the chamber will initially simulate altitudes up to 800,000ft, at temperatures down to −320°F. Later it will be provided with molecular traps for simulated altitudes of 475 miles at −454°F. Four additional chambers for the same type of work will be completed at Rye Canyon at the same time.

FAIREY RADOP AGREEMENT

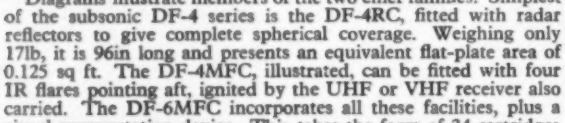
IT was announced last week that Fairey Engineering will market the Radop (radar/optical) towed-target systems developed by Del Mar Engineering Laboratories of Los Angeles. The agreement covers the UK, and most of Europe, Africa, the Middle East and Commonwealth. Fairey will handle installation, training, repair and maintenance.

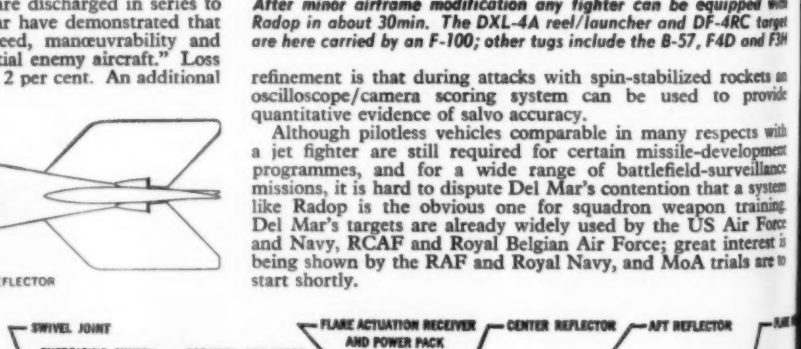
Key component of the Radop is a light, streamlined body containing radar reflectors to augment its radar cross-section to that of a large bomber. GCI can acquire it at 150 miles, and AI sets can lock-on at 20 miles. Any operational fighter can quickly be equipped with the target, 6.5 miles of fine wire and a launcher and windmill-driven tow reel.

Diagrams illustrate members of the two chief families. Simplest of the subsonic DF-4 series is the DF-4RC, fitted with radar reflectors to give complete spherical coverage. Weighing only 17lb, it is 96in long and presents an equivalent flat-plate area of 0.125 sq ft. The DF-4MFC, illustrated, can be fitted with four IR flares pointing aft, ignited by the UHF or VHF receiver also carried. The DF-6MFC incorporates all these facilities, plus a visual-augmentation device. This takes the form of 24 cartridges containing fluorescent powder, which are discharged in series to give a trail of luminous puffs. Del Mar have demonstrated that these targets can be flown "at a speed, manœuvrability and altitude comparable with that of potential enemy aircraft." Loss of performance to the tug is only about 2 per cent. An additional refinement is that during attacks with spin-stabilized rockets an oscilloscope/camera scoring system can be used to provide quantitative evidence of salvo accuracy.

After minor airframe modification any fighter can be equipped with Radop in about 30min. The DXL-4A reel/launcher and DF-4RC target are here carried by an F-100; other tugs include the B-57, F4D and F3H

Although pilotless vehicles comparable in many respects with a jet fighter are still required for certain missile-development programmes, and for a wide range of battlefield-surveillance missions, it is hard to dispute Del Mar's contention that a system like Radop is the obvious one for squadron weapon training. Del Mar's targets are already widely used by the US Air Force and Navy, RCAF and Royal Belgian Air Force; great interest is being shown by the RAF and Royal Navy, and MoA trials are to start shortly.





The two principal families of Del Mar target are represented by the subsonic DF-4MFC (above) and the supersonic DF-6MFC (right). The latter is 100.75in long, weighs 46lb and presents an equivalent flat-plate area of 0.132 sq ft

SOPWITH'S FIRST DECADE

Sir Thomas Talks of his Early Years in Aviation

ONE of the most famous names in British aviation is Sopwith; and its holder—Sir Thomas Sopwith, CBE, HONFRAES, chairman of the Hawker Siddeley Group—had much of interest to tell in a paper—*My First Ten Years*—which he was to deliver to the historical group of the Royal Aeronautical Society last Monday.

Sir Thomas recalled his very first flight, in a Henri Farman at Brooklands, and his acquisition of a licence ("ticket no 31") in November 1910. Since he had already bought two aeroplanes in succession (an Avis monoplane and then a Howard Wright biplane), he decided to try to get some of his money back "by having a go for the big prizes." (He had successfully bet several friends a fiver each that he would lie on his back in Piccadilly for five minutes without being moved by the police or anyone else. In those days, cars could be parked down the centre, so he lay under his for five minutes.) His first success as a prizewinner was for the £4,000 offered by Baron de Forest, whose aim was thus described by Sir Thomas: "When Blériot flew the Straits of Dover in 1909 this event struck the Baron as one of tremendous strategic importance to Britain. So to stimulate British aviation, then practically non-existent, he offered his prize (substantial in those days) for this ambitious flight in an aeroplane wholly manufactured in the UK. Its object was undoubtedly attained, leading as it did to the eventual formation of the Hawker Siddeley Group."

Sopwith won the de Forest prize with a flight of 169 miles in December 1910 and recalled it thus: "Fred Sigrist had a theory that the most likely time for an engine to fail was in the first few minutes of full throttle, so he advised me to start on the flight to the Continent from Eastchurch, which meant about half an hour's flying over land before the Channel. We took the Howard Wright by road from Brooklands to Eastchurch and a few days before Christmas there was a dead calm and I took off at 8.30 on the morning of December 18th. I had hoped to reach the Chalons-Rheims area. I passed over Canterbury at 1,000ft, this was my altitude record so far, and with a following wind was over Dover in half an hour.

Primitive Instrumentation

"Twenty-two minutes later I crossed the French coast, exactly where I have never discovered to this day, but I was very relieved to see it. My compass persisted in pointing NW no matter how I turned; so I steered by the sun but soon it was hidden by cloud so I continued to fly straight ahead as best I could, passing south of Lille where it was bumpy. Soon I crossed the Belgian frontier and it got so rough I was nearly thrown out, but hung on with one hand under the seat. We had no seat-belts in those days; nor did we have such luxuries as an air speed indicator. The only instruments were a rev counter which worked, a compass which did not and a barograph—a very sensitive one which Cecil Grace had given me, 6in in diameter and reading to only 2,000ft.

"The wind was rising and hilly country lay ahead, so I decided to land at the first favourable spot, a field near Beaumont. I still had 11 gallons left from the 20 with which I started, so if the weather had been better I could have covered over 300 miles. However, the distance in a straight line from Eastchurch was 169 miles and as the weather got worse no one else beat me and I was awarded the prize when the competition closed on 31st December."

Those were the days when aeroplanes could land almost anywhere and a flight of five miles could be full of adventure. Sopwith thus describes one he made by Royal invitation. "Early in 1911 I received an invitation from King George V to fly to Windsor—it was not exactly a command because the King knew full well the uncertainties of aviation then. So on 1st February I left Brooklands in quite a fog, having discovered it was clear at Windsor. On the way I landed on Datchet golf course to patch up a leaking radiator and then circled Windsor Castle and landed below the East Terrace. Customary protocol was put in reverse, as the King was waiting for me and led two small boys by the hand to examine the Howard Wright. The two princes were Prince Henry and Prince George."

It was in 1911 that Sopwith went to the US and won a great deal of prize money, subsequently starting his own aircraft company. This is how he describes those events:—

"That summer I went to the United States and after his great success there in 1910 Claude Grahame-White decided to go again, too. Between us we cleaned up a lot of prize money at the three main meetings at Chicago, Boston and New York. I was accompanied by Fred Sigrist as engineer and Claude by Reggie Carr in a similar capacity. Carr still works in aviation with Handley Page.

"Soon after arriving in America I was flying the 70 Blériot with Nelson Doubleday the publisher as passenger and spun into the ground—we were not seriously hurt and, of course, did not know then that it was a spin. He told me later that this was his fourth crash in five flights.

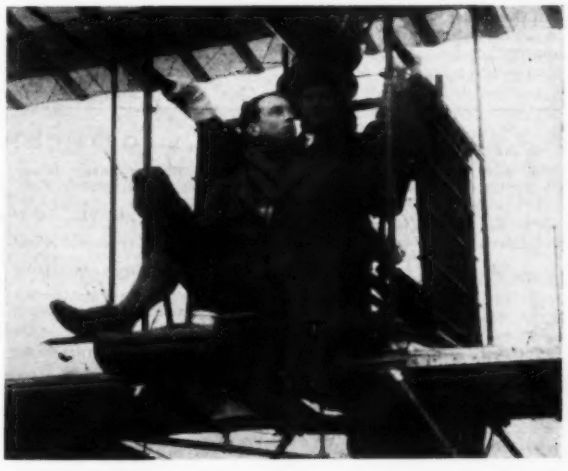
"One event I specially remember was a quick-starting competition when pilots had to run to their aircraft, start the engine and get cracking and the winner was the one who was airborne quickest. My time was 9 seconds so you see there is nothing really new in these 'new fangled' STOL aircraft. I did this on an American Wright biplane I bought in the States. I also took my 70 h.p. Gnome-Blériot to fly in speed events. Claude had a fast Nieuport monoplane like the one Weyman won the Gordon Bennett Race with and he cleaned up several races with it.

"Altogether I was lucky enough to win a lot of money in the United States. And with the £4,000 de Forest prize in the bank I began thinking of forming a company of my own. It is difficult to put an exact date to the start of the Sopwith Aviation Company—like Topsy it just growed. But it was the tiny seed that was to grow into the Hawker Siddeley Group of today."

Sir Thomas's lecture bristled with anecdotes about famous flying people in the 1910s—how Cody, "all dressed up, went to sleep in the train taking him back to Farnborough and woke up in Bournemouth" after a dinner held at the Café Royal to celebrate Sopwith's success in the 1912 Aerial Derby; about how four young Australians came to England to study flying, one of them being Harry Hawker, whose name is perpetuated in Hawker Siddeley; and how when the Royal Flying Corps was formed in April 1912 he was approached later in the year by a major in the Scots Fusiliers with a deep booming voice who wanted to join the RFC. "Unless he held an Aviator's Certificate within the next 10 days he would be over age to join, and asked me if I could get him through his tests in time. He was successful—Boom Trenchard—who was to become the Father of the RAF."

How times have changed is indicated by a reference to the War Office ban on monoplanes: "In September 1912 after a series of unexplained accidents to monoplanes in the RFC, the War Office decided this type must be inherently dangerous. In a panic they banned further flying in monoplanes by serving officers and it was some years before the Services repented and made an honest aeroplane out of the monoplane."

(*Concluded at foot of page 850*)



Pioneer days: Sir Thomas flying with a lady passenger (one of his sisters), in an early biplane in the times which his lecture recalls "Flight" photograph

FLIGHT SYSTEM SURVEY

Automatic Landing in the USA

THIS year US operators and manufacturers have moved into the automatic-landing field and some form of American practical application is now more certain than ever. But, largely because no specific operators' requirement has yet been stated, there is as yet no official airworthiness ruling and therefore no firm target for the designers. Without the statement of such a safety requirement, a system cannot take concrete shape; and to this extent the ARB has put Britain a long way ahead in what may now become a race. BEA and BOAC gave the ARB a start by first stating their operational requirements to the manufacturers of the Trident and VC10. Most notably of all, perhaps, the Blind Landing Experimental Unit (with Smiths Aviation Division) put Britain ahead by their pioneering practical work.

However much Britain tells the Americans about the technique, only first-hand experience will really allow them to catch up; but it must not be forgotten that a very great deal still remains to be done before even unscheduled automatic landing becomes a routine passenger-carrying operation anywhere. Our admitted lead is threatened more purposefully with every passing month and practical demonstration of the full system as it is at present being evolved will be indispensable in convincing US companies and authorities that we have taken the right course and that our advice must be followed. Otherwise some very different approach may be chosen and the critical international agreement on which British systems must eventually rely may not only be contested, but simply not concluded at all.

During a recent visit to Boeing Transport Division at Seattle, *Flight* talked about automatic landing with R. L. Utterstrom, staff engineer, electro-dynamics. Mr Utterstrom had followed closely what has been published about automatic landing in Britain; and Boeing have completed a good deal of practical work as part of the policy of "keeping ahead of customer requirements." The "dash 80" 707 prototype was landed with the Bell radar system some time ago and it has been shown that the 707 can be landed blind under control of its standard PB-20 autopilot. ILS guidance is disengaged at 50ft and attitude held, the round-out being initiated by an "eyeballed" (pilot-judged) tail-down pitch adjustment of the autopilot controller and completed by the natural ground-effect characteristics of the 707. This has been a confidence-inspiring exercise, and it is not claimed as a workable system for normal operations. The comparator of the PB-20 does nevertheless provide a degree of passive protection from failure that allows the use of autopilot authority which could not safely be misused. Nevertheless, safety in runaway with the comparator disconnected had to be satisfactorily demonstrated to the ARB.

Boeing have analysed weather factors for every important airfield in the world and they appear to have reached the conclusion, not solely by virtue of this analysis, that the airlines will greatly benefit in regularity of operation by an ability to reduce operating minima to 20ft ceilings. While this is important, it does not take into account the improvement in landing safety, as distinct from regularity, which is one of the major aims of British work.

Boeing are studying instrument presentations for pilot-controlled low approaches and are greatly impressed with the Smiths PVD, which they intend to test. The PVD would be used in combination with an autopilot and ILS capable of making approaches down to 20ft—regarded as feasible with existing equipment—and a flare-out device based on a radio altimeter.

Supporting this set of equipment, with which the human pilot appears to remain largely in control of the landing, would be advanced high-intensity approach lighting and precision approach radar. Mr Utterstrom strongly emphasized the practical and psychological benefit of precision approach radar as a monitor and human confidence booster for the guided approach by the pilot. Lighting could include the new near-flush "pancake" type of runway-surface lighting or even an extension of strobing approach lights down the centre of the runway itself. Great interest was also shown in British development of the more economical Fido.

Such a combination would be intended to allow only a lowering of present minima of about 200ft to about 20ft and would largely involve pilot take-over at very low altitude from a single-channel autopilot approach. The pilot would be left to "decrab" (i.e., kick-off drift), and at least limited reliance seems to be placed on ground-effect in cushioning the touchdown. A rate of descent at this point of about 2ft/sec is regarded as being a reasonable maximum.

All this is in fundamental conflict with British thinking, which holds that even automatic flare-out will not significantly reduce weather minima and that any pilot participation in automatic landing in other than a monitoring capacity is impracticable and, more important, cannot be definitely proved effective.

But Boeing are not convinced that automatic landing, even on a scheduled basis, will in the foreseeable future prove to be worth the penalty of highly complex equipment. Moreover, they are somewhat sceptical about the real value and validity of mathematical calculation of MTBF and similar factors. It would be preferable, they say, to adopt a single-channel system based on non-miniature components of extreme reliability such as large gyros and electronic tubes like those incorporated in underwater-cable amplifiers. Reliability calculations are questioned partly because of the extreme difficulty of ensuring that components survive all the human handling and transport involved in normal manufacturing sequences. Boeing have encountered such difficulties and have begun to require suppliers of electronic units to run their own acceptance offices right alongside the Boeing factory so that equipment is proved to be serviceable immediately before it enters the factory doors. A large proportion of unreliability can be directly attributed to the effects of miniaturization and to Murphy's Law at any stage of manufacture and assembly.

This does not mean that Boeing disparage the British work. They realize that routine fully automatic landing is inevitable, although it is a good ten years away. The extent and importance of British work really assumes its true proportions when viewed in such a context.

In the meantime the landing automation field is still held by Britain, and will be so until work begins in America on a specific civil system intended to meet a specific airline requirement. The FAA is unlikely to move until it receives a firm equipment proposal. One might say that the starter has raised his gun. When he fires it—and no one quite knows when that will be—the real race will begin. The British team is thoroughly warmed up and ready to go into action; the Americans still have their track suits on. But we must remember that they are in first-rate training for all that.

FORTHCOMING EVENTS

Nov. 25. RAeS Graduates' and Students' Section: Annual Dance.
Nov. 28. RAeS Agricultural Aviation Group: "The Farmer's Viewpoint," by J. B. Farrant.
Nov. 29. Institute of Transport (West Middlesex Group): "Airline Advertising," by A. J. Burkart.
Nov. 29. RAeS Rotorcraft Section: "The Design of Ground Effect Machines," by R. Stanton Jones.
Nov. 30. RAeS Man-powered Aircraft Group: "Some Aspects of Bird Flight," by John Barlee.
Dec. 1. RAeS Astronautics and Guided Flight Section (Main lecture at Luton Branch): "Ballistic Research Rockets: Black Knight," by D. J. Lyons.
Dec. 2. RAeS: Lecture Theatre Opening Ceremony.
Dec. 2. BritIRE (South Midlands Section): "The Electric Rocket in Space Propulsion," by W. A. S. Murray.
Dec. 6. RAeS Astronautics and Guided Flight Section: "Solid-propellant Rocket Motors," by Dr G. H. S. Young and Dr W. R. Maxwell.
Dec. 7. RAeS Agricultural Aviation Group: "Grass, Soils and Fertilizers," by I. A. Nicholson.
Dec. 7. Guild of Air Pilots and Air Navigators: Livery Dinner.
Dec. 7. BritIRE (Radar Group): "Flight Evaluation of Airborne Electronic Equipment," by H. G. Hinckley.
Dec. 7. BritIRE (North Eastern Section): "Human Engineering," by S. G. Ramsay.
Dec. 7. Kronfeld Club: "Air Transport in Brazil," by W. N. Tonkyn.
Dec. 7. Institute of Welding: Conference on Welding Standardization.
Dec. 8. RAeS: Symposium on Supersonic Aircraft.
Dec. 9. RAeS Man-powered Aircraft Group: "Aerodynamic Problems of Man-powered Flight," by T. R. F. Nonweiler.
Dec. 12. RAeS Historical Group: "Some Problems of Aeronautical History," by C. H. Gibbs-Smith.
Dec. 14. RAeS Graduates' and Students' Section: "BOAC and the Future," by Charles Abell.

RAeS Branch Fixtures (to Dec. 2): Nov. 28, *Boscombe Down*, "Hovercraft," G. Elsely; *Henlow*, Presidential Address. Dec. 1, *Belfast*, "Accident Investigation," by G. W. Acock; *Luton*, Main Society Lecture (see above) and Annual Dinner.

TALK WITH AN ASTRONAUT

BY KENNETH OWEN

"As they said when we started this programme," Gordon Cooper leaned back in his chair and smiled quietly, "nobody knows how to train astronauts. We'll be able to write the manual after we've been up there and made some flights. Right now, we don't always necessarily agree among ourselves what is the best training."

The man I was talking to spoke in a soft, Colorado accent. He was dressed casually in grey slacks and a blue, open-neck working shirt. A 33-year-old USAF captain; son of an Air Force colonel; married, with two daughters aged eleven and ten; youngest of the seven Project Mercury astronauts and the one whose main responsibility was the Redstone booster. This was Leroy Gordon Cooper Jr, the man most likely to take the first human ride into space on an American ballistic missile.

Although the Mercury programme timing is such that the seven astronauts are now spending an increasing amount of time at Cape Canaveral, their home base is at Langley Field, Virginia. Here, in a group of elderly buildings tucked in between the massive wind tunnels of the National Aeronautics and Space Administration's Langley Research Center, are the headquarters of the Space Task Group—a NASA team of scientists and engineers whose job is simply to achieve manned spaceflight. It was at Langley that I talked with Gordon Cooper and with the Director of Project Mercury, Mr Robert R. Gilruth.

Notwithstanding Cooper's remark about making some flights "up there" first, and writing the manual second, the Mercury training programme as it stands is impressive. The astronauts themselves are in no doubt of the value of the training, as indicated by their own readiness: "Yes, we could have made a flight prior to now," Cooper told me. There is no feeling that the astronauts might become stale through over-preparation. "There's never enough time. We're operating practically on a seven-days-per-week schedule now. And, of course, when we do go we'll be better prepared than we are now."

Before looking in detail at the various aspects of the training of these seven men, it is relevant to go back a step to their initial selection. What type of man was wanted for this assignment, and how was the selection carried out?

Again, to start with, nobody knew the specifications of the ideal astronaut. But the mission had been defined (*Flight*, February 12, 1960), and it was known that the Mercury pilot would have to communicate with the ground, make scientific observations, monitor on-board equipment, control the capsule attitude, navigate, possibly fire retrorockets, initiate emergency procedures, activate escape system and deploy landing parachute if required.

More basically, Project Mercury was concerned primarily with one thing—to demonstrate that man can exist and function effectively in space. The astronaut is therefore the subject of a biomedical experiment.

Thus it seemed that the astronaut must be an experienced pilot-engineer, a scientist, and a suitable biomedical subject. This was translated into seven selection criteria: (1) age less than 40; (2) height less than 5ft 11in; (3) excellent physical condition; (4) bachelor's degree in engineering or the physical sciences; (5) graduate of a test pilot school; (6) 1,500hr flying time; and (7) qualified jet pilot. The height restriction was based mainly on the size of the spacecraft.

The phrase "excellent physical condition" includes as a most important part the candidate's mental and emotional health. As the astronauts' personal flight surgeon, Lt-Col William Douglas, has pointed out, "The psychological make-up of the astronaut must be one of great rarity in our society. He must be a man who can work as a member of a group for a long period of time, contributing his share and accepting the contributions of others with grace and confidence. Then he must, quite suddenly, become a lone wolf; completely self-sufficient and self-confident.

"Although he will have radio communication with ground stations, and have the best advice of experts available to him on request, the orbiting astronaut must, in the truest sense of the word, be a man who thinks for himself. A high order of intelligence is a must . . ."

No other group of men, in good or bad health, can have been subjected to such a thorough psychiatric evaluation as the original Mercury candidates. In addition to the characteristics quoted above by Col Douglas, particular attention had to be directed towards a man's ability to cope under high levels of stress, and his motives for wanting to be an astronaut.

The records of 508 military test pilots were reviewed, of whom 110 met the seven basic requirements. A total of 41 were eliminated through further investigation, after which the remaining 69 pilots were called to Washington and invited to volunteer for Project Mercury. The 55 who accepted were given interviews and psychological tests, on the basis of which 32 were chosen for the final phase of selection. This phase was designed to evaluate each candidate's medical and psychological status, and to determine his capacity for tolerating stress. Included were psychiatric interviews (How, I wondered, were the psychiatrists selected?); thirteen motivation and personality tests; twelve intellectual and aptitude tests; and experimental stress-raisers involving pressure chambers, isolation chambers, complex behaviour simulators, accelerations on a human centrifuge, noise, vibration and heat.

After these formidable medical obstacles had reduced the field to manageable proportions, in fact to 18 men, the chosen seven were determined on the basis of the engineering and scientific ability demanded by the technical aspects of the Mercury programme. The seven are Lt Malcolm Scott Carpenter, USN, 35; Capt Leroy Gordon Cooper, Jr, USAF, 33; Lt-Col John Herschel Glenn, Jr, US Marine Corps, 39; Capt Virgil Ivan Grissom, USAF, 34; Lt-Cdr Walter Marty Schirra, Jr, USN, 37; Lt-Cdr Alan Bartlett Shepard, Jr, USN, 37; and Capt Donald Kent Slayton, USAF, 36.

The astronauts' training as a group can be broadly divided into six areas: (1) training in spacecraft operation; (2) education in space sciences; (3) familiarization with conditions of spaceflight; (4) physical fitness; (5) training in ground activities; and (6) maintenance of flight skills. In addition, each of the seven is responsible for a particular aspect of the overall development of the Mercury programme. Carpenter is responsible for communications and navigational aids; Cooper for the Redstone booster; Glenn the crew space layout; Grissom the automatic and manual attitude control system; Schirra the life support system; Shepard the range, tracking and recovery operations, and Slayton the Atlas booster.

On the day of my visit Gordon Cooper had spent 1½hr on each of two simulators—one dynamic, one fixed-base—representing the Mercury spacecraft. His first session was in the McDonnell Procedures Trainer, which does for the Mercury vehicle what the familiar flight simulators do for commercial and military aircraft. This is located literally beneath the huge full-scale wind tunnel at Langley.

This trainer gives practice in sequence monitoring and familiarization with the systems and "cockpit" in general; external reference through the periscope is simulated by means of a cathode-ray tube display; and provision is included for pressurizing the astronaut's suit and for simulating heat and noise. Also included in the same room, for the equally essential training of the personnel who will man the 17 Mercury tracking stations across the world, are the three ground-control consoles (for doctor, spacecraft communicator and systems monitor) which will form the minimum equipment at any one of the tracking stations.

Preparing for simulated flight in the centrifuge at US Naval Air Development Center, Johnsville

Astronaut Cooper at the Mercury-type controls in the gondola of the Johnsville centrifuge

Pilot Cooper at the controls of a TF-102 aircraft

Walter Schirra "flies" the ALFA trainer at Langley

Talk with an Astronaut . . .

At Cape Canaveral, an identical procedures trainer is linked to the main Mercury central control room so that complete orbital flights can be simulated to the fullest degree.

The second device on which Gordon Cooper had practised that day was the ALFA simulator, one of three dynamic trainers used to develop the astronauts' skill in controlling the attitude of the Mercury capsule. This simulator (the initials stand for Air-Lubricated Free Attitude) consists of a shaped couch in which the astronaut rides, mounted inside a framework of metal beams and tubes which in effect rides on a cushion of compressed air. The astronaut controls his attitude by operating a side-arm controller, a duplicate of that fitted in the actual Mercury capsule, with his right hand. This movement, described by Cooper as

Nerve-centre: Mercury central control at Cape Canaveral

While project heads consult at Langley (below), astronauts practise desert survival in Nevada (right). Mercury director Robert Gilruth is second from left; with him are (from the left) Charles Donlan, Maxime Faget and Robert Piland of the NASA Space Task Group

being similar to a conventional stick plus a motor-cycle-type handgrip in place of a rudder, is connected to air jets which simulate the action of the Mercury vehicle's reaction control system.

A view of the Earth, appearing to move at a rate equivalent to that seen from a satellite in orbit at 100 miles, is projected in colour on to a large screen, and is viewed through a reducing lens to provide the periscope display. Training in the use of Earth-reference for navigation is also possible.

Simulation of the accelerations which will be encountered during ballistic and orbital Mercury flights has been accomplished not at Langley but on the 50ft-radius centrifuge at the US Navy's Aviation Medical Acceleration Laboratory at Johnsville, Pennsylvania. In the most recent Mercury programme at Johnsville, during October 3-21, a Redstone-boosted suborbital flight was simulated, including the transmission of medical data from the two-gimballed centrifuge gondola to the medical monitor teams who were also undergoing training there.

Acceleration loadings up to 40g can be provided at Johnsville, and each astronaut has taken as many as 16g—about the highest g load that could be encountered in a Mercury flight.

The third dynamic simulation device used is the three-gimballed Multi-Axis Spin Test Inertia Facility (MASTIF) at the NASA Lewis Laboratory. In this, tumbling rates up to 30 r.p.m. in all three axes are simulated, giving the astronaut practice in damping this tumbling and stopping the rotation of the vehicle.

Another useful facility which has come into use in recent months is an environmental control system simulator at the Navy Aircrew Equipment Laboratory in Philadelphia. Here a capsule mock-up (containing flight-type environmental control hardware) is placed and operated inside a large decompression chamber.

NASA engineer Charles Olasky at the instructor's console of the McDonnell-built Mercury procedures trainer at Langley

Talk with an Astronaut . . .

The use of these major facilities for training the astronauts to operate the vehicle is accompanied by group lectures, discussions and visits, and by individual reading, report writing and plain, honest-to-goodness midnight-oil-burning study. At Langley the astronauts occupy one large office with seven desks, and have the use of an adjoining library/study room.

The flow of paperwork, covering all aspects of the programme and not just the vehicle-training side, includes reports, memoranda and records passing between the Space Task Group, NASA Headquarters in Washington, the Marshall Space Flight Center at Huntsville, the Cape Canaveral launch site and control centre, McDonnell at St Louis, and other establishments and groups. Visits by the astronauts have included the above and also Edwards Flight Test Center, Air Force Ballistic Missile Division, Rocketdyne, Space Technology Laboratories and Convair-Astronautics.

The astronaut must not only be able to operate the Mercury vehicle, but also have a good general knowledge of space sciences such as astronomy, astrophysics, meteorology, geophysics, rocketry, physiology, space navigation and trajectories, so that he can observe and understand the new phenomena which he will experience. Following a course of lectures along these lines, practical training has included astronomy sessions at the Morehead Planetarium, Chapel Hill, North Carolina. A Link trainer body was modified, using a window and headrest to simulate viewing conditions in the Mercury spacecraft, and in this the astronauts have been able to practise star recognition while the planetarium was programmed to simulate orbital flight.

Familiarization with the conditions of spaceflight is the third aspect of the astronauts' training, and eight relevant conditions have been reproduced. These are high acceleration, weightlessness, reduced atmospheric pressures, heat, disorientation, tumbling, increased carbon dioxide, noise and vibration.

Acceleration patterns similar to those of the planned Mercury flights have been experienced by the astronauts on the centrifuges at the Wright Air Development Division at Dayton and, as mentioned, at Johnsville. During this training the astronauts have developed straining techniques which have reduced blackouts and chest pains. Weightlessness has been experienced in C-131 and C-135 aircraft (with the astronauts floating freely in the main cabin); and in the rear cockpit (strapped in) of an F-100F for periods up to one minute. Disorientation was inflicted on the seven earlier this year in what the US Naval School of Aviation Medicine mysteriously calls its Slowly Revolving Room.

No formal physical fitness programme was laid down for the astronauts since, as intelligent adults—the understatement of the year—they could be expected to realize the importance of physical fitness and to act accordingly. This they have done, favouring skin diving and water ski-ing in the spring and summer, squash and handball in the colder months, and running all the year round. All seven have reduced or completely given up smoking and some, with a tendency to be overweight, have been keeping a close eye on their diet.

Training in ground activities has covered countdown procedures, ground flight-monitoring procedures, and recovery and survival. The six astronauts left on the ground when the manned flights take place will have important parts to play during the countdown and the actual flight—at the blockhouse, at the central control, and at the down-range stations. Fully familiar with the operation of the capsule and a close friend of his colleague in the capsule, each of the six will be a particularly useful man to have on the end of a microphone on the ground in touch with the spacecraft in orbit.

Recovery and survival have been the subjects of lectures, discussions and practical training. The astronauts have learned how to get out of the capsule while dunked in a wave-simulator tank at Langley and later in the Gulf of Mexico. The scheduled recovery areas are all in the ocean, but in emergency a descent anywhere between about 40°N and 40°S is a possibility. Recently the astronauts practised land survival in the Nevada desert, remaining there for four days and improvising individually as best they could (the Arab-style headgear worn in the photograph on page 843 began life as a Mercury capsule ringsail parachute).

At the Space Task Group headquarters at Langley, Gordon Cooper calls in on Lt-Col William Douglas (above left) and fellow astronaut Alan Shepard (above). Col Douglas is personal flight surgeon to the seven astronauts and their families

At Cape Canaveral, astronauts Cooper and Donald Slayton visited an Atlas launch pad earlier this year. Outside visits, increasingly to the Cape, form an important part of the Mercury pilots' training

The final aspect is the maintenance of flight skills—for a programme in which the total flight time per man in the Mercury capsule will be no more than four or five hours over a period of three years. The astronauts themselves feel strongly that skill in "piloting" the Mercury capsule cannot be maintained with ground simulators alone. Gordon Cooper, it was obvious, is particularly keen on flying—as befits someone who began to take the controls in his father's Command-Aire at the age of seven, soloed at 16 and used a Piper Cub for a flying honeymoon (his wife Trudy is also a pilot).

In the USAF he flew F-84s and F-86s for four years in Germany and, after obtaining a degree in aeronautical engineering at the Air Force Institute of Technology at Wright Patterson Air Force Base, was assigned to the Experimental Flight Test School at Edwards AFB, where he graduated as a test pilot.

Until recently the astronauts have had the use of two Air Force F-102s based at Langley. The Air Force unit which operated these aircraft is now changing over to F-106s, and the astronauts hope to resume their regular flying on this type. Cooper was flying F-106s at Edwards immediately before his Mercury appointment.

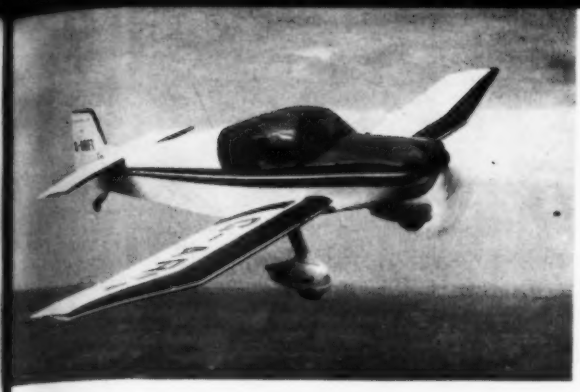
On the day of my visit to Langley, the remarkable programme of these remarkable men was interpreted as follows: Schirra, Cooper and Glenn were at Langley, spending most of their time on the ALFA simulator and the procedures trainer. Carpenter, Shepard and Grissom were at Johnsville. Slayton was attending a co-ordination meeting at Cape Canaveral with ground support personnel who will be assisting during the Atlas launchings.

But why put a man in orbit anyway? Gordon Cooper had no hesitation: "They just haven't built a computer that can reason and take alternative courses of action yet." Did the fact that he was the Redstone specialist mean that he would probably ride the Redstone on the first manned ballistic shot? He answered "I would like to think so," but his eyes gave a definite "yes."

My talk with an astronaut had continued well past dusk—not that we had bothered to switch on the lights, such was the fascination of our subject. The Coopers live on the base at Langley with their young daughters Camala and Janita and, as Gordon Cooper mounted his motor-scooter and prepared to head home, I apologised for keeping him from his family—and from the stereo hi-fi system which he hopes to get around to completing soon.

A buzz of the two-stroke and a wave of the hand. Early next year it could be a Mercury capsule on top of a Redstone booster. Watching him leave on that occasion would be, not just a British journalist, but a control room full of anxious men.

[*Next week: an interview with the Director of Project Mercury*]



Frenchmen from Bernay

JODEL AMBASSADEUR AND MOUSQUETAIRE

Nos. 135 and 136 of the "In the Air" Series

IF you go shopping for a light aircraft in France, you can be sure to buy something the like of which is produced nowhere else in the world. It is not simply French *chic* in design and finish, though that is there in abundance, nor Gallic logic applied to cockpit layout and minor controls, though that, too, is much in evidence. Much more it is a happy approach which puts first things first, so that French aeroplanes are practical tourers, handle well, are aerobatic and are built to such a highly competitive price that even after import duty is paid value for money in the UK is as good or better than for anything else now on offer.

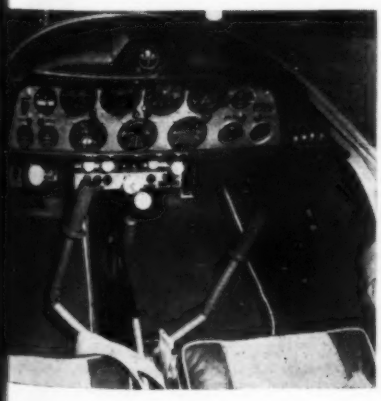
Being demonstrated by Rollasons of Croydon in Great Britain now are the two latest models in the Jodel family, the DR 1050 Ambassadeur three-seater and the altogether larger and faster 4/5-seater Mousquetaire. The former is a direct descendant from the 90 h.p. two-seater D.117 through a series of variants which first increased the capacity to three seats and then the power to 100 h.p. The DR 1050 in France has full approval in the transport category. Something like 180 have already been built and manufacture continues at the rate of three or four a week. Powered by a Continental O-200 flat four it sells in this country at £2,800 less radio and full blind flying panel. Even when these extras are added (£316 for venturi-operated blind flying instruments, £235 for a twelve-channel Airstal VHF radio and £84 for a manual ADF) the total price is still under £3,500.

The Mousquetaire, being larger and—with its 180 h.p. Lycoming O-360A 2A engine—much more powerful, is naturally more expensive. But for a basic price of £4,620 one can obtain a 4/5-seater with a really generous luggage allowance even when sufficient fuel is carried for a safe endurance of six hours. The Mousquetaire can in fact lift fuel and payload to within a few pounds of its empty weight and cruise with that load at 140 m.p.h. for something like 800 miles.

Side by side on the ground the two Jodels display very clearly their family likeness. The Ambassadeur in particular is much cleaner than its forebears and manages to look just right from almost every angle.

The trailing edge of the wing is close to the ground and access to the cockpit is easy. There are walkways on either side and both portions of the split front canopy are swung forward for step-down entry into the cockpit. This is easy enough for the front seats but a bit more awkward and ungainly for the passenger in the back. I would like to think twice before asking my aged aunt to climb in. Although elbow room is restricted and the seats are on the narrow side, they tilt and are adjustable through about 3½in so that altogether the driving position is very comfortable.

When the canopy halves are swung back into place, locked with the lever handle and secured with a common central toggle, the cockpit is extremely snug. The view is quite exceptional, lack of canopy frames aft of the rather fragile-looking windscreen arch giving the impression of an open cockpit. The glassfibre nose cowling also slopes away forward quite steeply; allied to a shallow ground angle, the view forward is comparable to that conferred by a nosewheel. There is a reminder on the check list to "hold the stick well back when taxying"; I found the sensation of sitting on a tricycle undercarriage so strong that I held the stick back very hard indeed. The brakes are differential, assisted by a semi-steerable tailwheel spring-connected to the rudder and there is a powerful central parking brake with a swing-over ratchet.



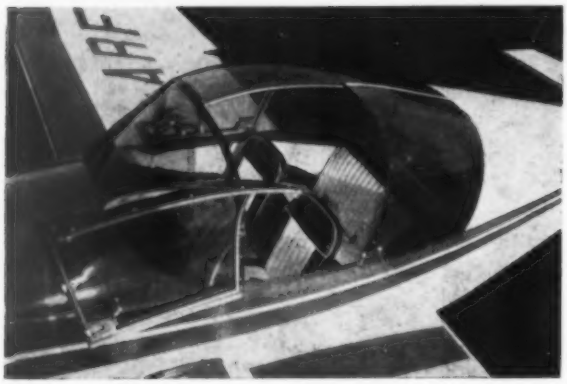
This Rollason-demonstrator Ambassadeur is equipped with a full blind - flying panel, mostly of metric instruments although the altimeter reads in feet. On the extreme left is the trim lever, the parking brake is in the centre and press-to-test buttons for the electrical warning lamps are on the ledge on right

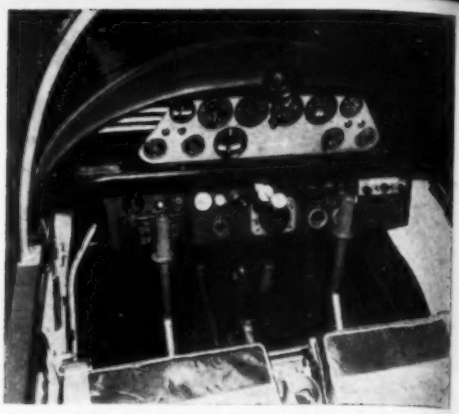
Vital action drill is conventional except for a check on the warning lights which come on when either front or rear 12 Imp gal fuel tank is down to its reserve three gallons, oil pressure is low or the air brake is lowered. A row of four buttons on the starboard side of the panel enables each warning circuit to be checked individually. Another action is to select on the venturi-suction gauge the artificial horizon and D.I. The lines are controlled by diminutive buttons on the instrument which are pulled out and rotated from *fermé* to *ouvert*. Both artificial horizon and directional gyro are normally left caged until the aircraft is airborne. The final action is to check that the fuel booster pump is on.

A little right rudder is required to counteract take-off swing and the Ambassadeur flies itself off at about 70km/hr, accompanied by an intermittent croaking from the stall-warning device in the leading edge and an occasional flash from the warning light. With the Continental buzzing merrily at full throttle and 2,500 r.p.m. I timed the rate of climb through 2,000ft at 2min 30sec.

At 3,500ft I levelled off, adjusted the power to maintain 2,500 r.p.m., and weakened the mixture to hold these revs at the minimum throttle setting. This is the recommended procedure at any altitude from ground level upwards. At this height, one up, and the tanks half full of fuel, the Ambassadeur settled down to cruise at a shade over 120 m.p.h. In cruising flight the nose is well below the horizon and I had to bring the sensitive trimming handle just below the port sill into a position about a third of its range nose-down from the neutral position.

In still air this pleasant little aeroplane flies hands off and the controls are pleasantly harmonized. Only a touch of rudder was needed to produce balanced turns. Enjoying a rare cloudless morning I wound it round the sky for a few minutes and gained 500ft; concentrating on the sensitive rate-of-climb indicator, calibrated in m/sec, I repeatedly pulled it round into the vertical without losing height. Stick forces were a shade on the high side but response in all three planes was really crisp. Stability was positive in pitch and yaw and neutral over very small deflections in roll, but in spite of the cranked wing tips a 10° lateral deflection port or starboard resulted in a tightening descending spiral. This was more pronounced to port than to starboard. Stability charac-





The way in to the Ambassadeur is shown on the left. The Mousquetaire's canopy opens upwards giving access to the cockpit (above). Only a partial panel of instruments is fitted here, but more can be added as extras. The lever on the left operates the flaps, the central lever the brakes. The two instruments to the left of the top panel are gauges for the 28gal front and 20gal rear fuel tanks; the selector is immediately below them and the boost pump switch immediately to the left

FRENCHMEN FROM BERNAY . . .

teristics were similar at a typical down-wind speed of 120km/hr.

The initial stall was innocuous. At 3,500ft light and buzzer gave me a pre-stall warning at 95km/hr and with the stick hard back a clean stall occurred just below 70. The nose dropped immediately and the buzzer stopped. Aileron control remained down to the stall, although not beyond it. The elevator was extremely powerful and effective; held back, a second much more violent stall occurred with pronounced aerodynamic buffeting and eventual wing drop. The nose also rose so sharply that I was pitched forward. Stalling characteristics are almost identical with the airbrakes down. I measured the minimum flying speed with full power at 65km/hr, and there was sufficient power when the nose was lowered to achieve a climb or nearly 350ft/min.

Good control characteristics near the stall make the Ambassadeur pleasant and easy to fly on the approach. The airbrake can be lowered below 155km/hr by the central lever between the seats and is accompanied by a pronounced nose-up change of trim. If left unchecked the airspeed then falls off appreciably, so it seems advisable to get the brake down and the aircraft re-trimmed well before settling down on the final approach at about 110km/hr. But the buzzer is there to guard against sins of omission and, because it is set fairly high—at about 1.4 V_S—it croaks again during the flare-out. There is some float and, as I had expected from trying its effect in the stall, the elevator remains fully effective in landing from a glide approach. It may indeed be a shade too powerful, bearing in mind the shallow ground angle, and on the first of several landings I touched tailwheel first with some travel to spare. The run is very short, and with a little brake—the Ambassadeur can be set gently down in not much more than 100yd.

If you want to enjoy your flying with your wife and children, tour for five hours or so at 4½gal/hr in a heated cockpit, or go off and do aerobatics by yourself, it is hard to imagine an aeroplane in which you could do it more cheaply and comfortably.

For the more serious air touring enthusiast or the man who uses his aeroplane for business as well as for sport, Société Aeronautique Normande have developed the D 140 Mousquetaire. About 50 have so far been built and orders for many others are in hand. It differs from the smaller Ambassadeur in having a more generous cabin with room for four adults and a child, capacity for a maximum of 200lb of baggage in a vast locker aft of the cabin or for 44lb with full fuel and five occupants, and a higher cruising speed. On this model the canopy opens upwards Gemini-fashion on each side but it is counterbalanced so that opening and closing loads are extremely light. The Rollason de luxe demonstrator is fitted, as a highly desirable if somewhat expensive optional extra, with a constant-speed McCauley propeller, an Airstal 20-channel VHF radio and a Radiostal ADF. Slightly more elegant entry is possible than into the Ambassadeur, but it still does not really compare with the large doors now being offered on US executive types. A more generous width of cockpit has made possible more comfortable seats and these adjust through about 2½in on runners over the spar box. Cockpit layout is broadly similar to the Ambassadeur but there is a two-position flap lever on the left, a diminutive knob instead of a lever for elevator trim, and the control panel is differently arranged. On the whole I thought that it was slightly less tidy than on the smaller aircraft but everything is within view and within a comfortable arm's reach. Flight instruments are centrally located in the top panel, fuel gauges on the left and engine instruments on the right, while the whole of the lower panel is given over to controls and the radio installation.

After starting and warming up I moved out down the perimeter track and found the same easy taxying characteristics that I had experienced on the Ambassadeur, although foot loads on the differential brakes are rather higher.

Swing to the left was fairly pronounced during take-off, unstick occurring at about 70km/hr. The excellent view is a family characteristic and at full throttle climb which left 3,000ft behind in 3min 10sec the forward view was more than adequate. Stability is more marked on the larger aircraft and, although there is no rudder trim, in still air the Mousquetaire climbed hands off and with only a touch of rudder.

At a typical cruising setting of 2,400 r.p.m. and 80 pièzes (about 80 per cent of atmospheric pressure) speed built up quite rapidly to 220km/hr (about 137 m.p.h.). The Mousquetaire trims out nose well down and the view in all directions is excellent. Although some draughts escape the canopy seals the interior is kept comfortably warm by the heater, but noise level is rather obtrusively high.

The Mousquetaire is more stable than the Ambassadeur in yaw but has longer-term damping in pitch. A 10° lateral deflection either way showed it to be neutrally stable to port, slightly unstable to starboard, but it flew very comfortably hands-off in still air. Harmonization is pleasant but aileron forces were a shade high in relation to those of the elevator. Static friction is similar in both circuits.

If there is one characteristic that stands out above all others it is the astonishing speed range of the larger Jodel. I had to wait for the stall for a very long time indeed before it finally occurred, clean, at 50km/hr with some aerodynamic warning buffet. As breakaway occurred the nose dropped gently forward and continued application of full elevator produced nothing more alarming than a series of mild switchbacks. With full flap the stall occurs right off the clock—by extrapolation at the equivalent of about 32 m.p.h. All these characteristics add up to an aeroplane that, without high lift devices or other complications, can be landed safely and slowly. Recommended approach speed is between 100 and 120km/hr and I found no difficulty in holding a trim speed of 110 from base leg down to the flare-out. The flap is quite powerful in its fully deflected 50° position and steepens the angle appreciably. I just ran out of trim in a glide approach.

To add to its pleasant characteristics near the ground the Mousquetaire has ample power for an overshoot with full flap down, when the out of trim loads are quite moderate; it can also be side-slipped and, as it sheds its speed quite quickly during the flare-out, it can be popped down almost on to a particular blade of grass. On the soggy aerodromes of last week that is a characteristic for which I was particularly grateful.

You can travel faster than the Mousequetaire on the same power and you can travel more quietly. But I know of no other aeroplane in which you can, at one and the same time, lift so much load, travel so far, do aerobatics, land so slowly and find such viceless handling. Fit a full panel of instruments, a v.-p. propeller, 20-channel radio, ADF and VOR and the starting price is only just the other side of £6,000. Is there better value than that?

ALASTAIR PUGH

Jodel D 1050 Ambassadeur

Dimensions: Span, 29ft; length 21ft.

Weights: Max take-off, 1,650lb; empty, 900lb.

Performance: Max speed, 133 m.p.h.; cruising speed, 120 m.p.h.; take-off run, 280yd; landing run, 130yd; endurance with 30min reserve, 5hr.

Jodel D 140 Mousquetaire

Dimensions: Span, 31ft; length, 24ft; height, 6ft.

Weights: Max take-off, 2,530lb; empty, 1,320lb.

Performance: Max speed, 162 m.p.h.; cruising speed, 140 m.p.h.; take-off run, 220yd; landing run, 190yd; endurance, 6hr; range, 600 st.m.

Off the Ground

By Alastair Pugh

No 1 OF A NEW SERIES: RIDING THE HOVERSCOOTER

THE first American hovercraft to come to England reached Southampton in a large wooden crate a couple of weekends ago. I first saw it shortly after it had been unpacked: a bright red platform with an arching trunk, at the front of which welded tubes supported a two-cylinder in-line Yamaha motor cycle engine. And that really was all; this was completely a prototype, the second to be built by Rhodes Inc of Pittsburgh, Pennsylvania, hurriedly finished in time to be shipped over for our associated journal *The Motor Cycle* to assemble, test-fly and display at the Motor Cycle Show at Earls Court last week.

It took some hours to fit the nose cowling and propeller, fins and batteries. I was glad to lend a hand; you get a better idea of how something functions if your coat has to come off a few times before it's ready to be run. In the first place, the exceptionally light "Royalite" expanded-rubber sheet from which the whole outer skin is vacuum-moulded had lost some of its shape and fitting the tapered aluminium cowling around the Sensenich wooden propeller was a tedious business. With only a 250 c.c. engine to supply the power, propeller clearance and a good entry are important.

Within the outer shell, and forming the peripheral annulus through which the air curtain is ejected, is a polystyrene buoyancy float, while above this a moulded cone reduces the area of stagnation pressure within the centre of the chamber. Light-gauge tubular support members complete the structure.

The operating principle of the Hoverscooter—its American manufacturers call it the AirRhoCar after the name of the president of Rhodes Inc, Mr Charles Rhodes, and the mass density symbol ρ—is thus identical to that of the Saunders-Roe SR-N1. Air is drawn in through the intake by the ducted fan, and ejected in a continuous curtain through the 2.0in wide slot around the 9ft periphery. The duct is inclined inwards at 45°—an empirical choice, but one which Mr Rhodes said had been proved as the best compromise by Princeton University, with whom he has collaborated during the design. He said also that no patent rights exist on this principle in America, which was devised by NACA in 1953—the same year in which Mr C. S. Cockerell was conducting his experiments into air-curtain systems in this country.

The ingenious system used for yaw control was quite new to me. Within the slot are mounted over 100 polythene vanes, each carried on a simple wire pivot. A nylon cord runs through them all and an associated "knotted string" ensures that they all move in unison—the action being controlled by a bell-crank lever at the rear of the vehicle coupled to the handlebars by Bowden cables. The only other mechanical control is a twist-grip throttle which governs engine speed and thus—more or less directly—hovering height.

My first attempts at operating the scooter were confused, to say the least, by the cables being coupled so that they moved the steering vanes in the sense of a rudder bar but unlike that of bicycle handlebars. You can take your choice as to which the control most closely resembles. Another problem was that although the manufacturers claimed that the engine developed 23 b.h.p. at 6,000 r.p.m., both power and revs fell well below specified performance, and over the grass-lawn testing ground hoverheight was less than 2in. On this type of device, where no propulsion efflux is provided, this is insufficient; directional control is achieved by adjusting the centre of gravity so that the platform tilts, and this modifies the shape of the air curtain and its pressure distribution. In other words, you lean in the direction you want to go.

From a hurried discussion with Carl Mikan, Rhodes' chief engineer who had supervised assembly, was evolved the idea of a flexible curtain, as employed on the Curtiss-Wright Aerocar and other US ground-effect machines. A local sailmaker ran one up in a surprisingly short time and it was laced into position around the lip which already exists for this purpose.

The effect on hoverheight was dramatic, the whole scooter now lifting six inches off the ground and about two inches clear of the curtain. Unfortunately, it also became completely unstable, any effort at directional tilting destroying the air curtain and causing one side of the vehicle to dig ignominiously into the turf. The first public demonstration now only 24hr away, the curtain was hurriedly halved in depth and the Hoverscooter tested again. This time results were more satisfactory and at last I was able to try my hand at this new form of locomotion.

Any doubts as to the efficacy of a 250 c.c. engine to function as a prime mover were quickly dispelled when I opened the throttle; almost as soon as the little engine began to two-stroke properly the 200lb scooter with its 160lb load began to lift. Standing just off the saddle and rocking the platform to find the equilibrium hover position got the device properly airborne. It was then stable laterally and in pitch (in rock and roll so to speak) and stable, too, in space. Directional impetus is achieved by leaning forwards but some skill and practice is required to ensure that motion takes place in the correct direction; and any attempt to correct it sets up a rotation. Control in all senses is highly anticipatory and use of full handlebar deflection except to initiate a rotation is an admission of failure. Operated over the centre of their range, and in spite of a generous response lag, the vanes give fairly satisfactory rotational control while the scooter is in motion, but any attempt to change direction by body sway is accompanied by a rotational motion that is difficult to bring under control.

After several attempts I was able to get the machine moving in a reasonably straight line in a predetermined direction; it accelerates slowly but inexorably until it is moving forwards at perhaps 5-6 m.p.h. There is no yaw stability at all (the rudders are locked and are not designed to be effective below 15 m.p.h.) and handlebar control movements must be made to maintain direction; rotation must also be accompanied by body movements to keep the centre of gravity ahead of the tilt centre and in line

(*Concluded at foot of page 850, col 2*)

The first ground-effect machine of its class to be seen in Great Britain: top right, the Hoverscooter before assembly of the cowl and fins; top left, the author explains to Carl Mikan of Rhodes Inc the frustrations of the control system; and, bottom right, Mikan takes the scooter on the lake to show what can be done with it—and how

Straight and Level

MY old friend Sir Charles Boost, fit and well again after hearing of Convair's plans to have an American supersonic prestige airliner in service by 1965, was in fine form at last week's annual dinner of the British Imperial Air Power League.

"We British have the guts and genius to smash Yankee competition into smithereens," he declared. "If only these blasted civil servants would wake up instead of footling and fussing about a few million quid, this grand old country and Empire of ours might get somewhere—eh, Minister?"

Sir Charles tweaked the ear of the Minister of Planes, Mr Hugh Strangeways, who was busy flicking rolled-up breadcrumbs at Sir John Blackout-Jones, chairman of Scruggs.

"I say again," he continued, "that we could have a Mach 6 plasma jet flying next year, making an absolutely super noise and smashing the Yankees for six—Mach six, eh, Minister? Just imagine what prestige such a machine would bring to our Imperial air communications! Never mind about cost per seat-ton, or whatever it is, it's PRESTIGE per seat-ton that matters to this grand old . . ."

At this point a bread roll aimed by Sir John Blackout-Jones at Dr J. Nit missed its target and hit the speaker on the nose. In retaliation Sir Charles put on his Gosport helmet and goggles and ran round and round the top table, arms outstretched, doing his well-known imitation of dogfighting in an S.E.5A.

● This is how Oliver Stewart, Editor of *Aeronautics*, in his paper "Forty Years of Aviation Writing," imagines that the *Daily Express* would describe the first flight of the Wright Brothers if it were to happen today. Under the heading SALUTE THESE MEN! the leading article would run in this way:—

"Praise these two brothers. Their invention earns the applause of the world. Experts told them flying was impossible. Their friends laughed at them. Officials obstructed them. But they persisted. And they triumphed. Theirs is a mighty victory."

Then, after a break, the leader writer, bearing Lord Beaverbrook in mind, would go on:—

"Britain will benefit from the invention of the airplane. Why? Because the airplane will bind the Commonwealth."

Correction, Oliver—"Empire."

● Extract from *The Rules of the Air and Air Traffic Control Regulations 1960*: "Rule 42. Paragraph 6. A rectangular green flag not less than two feet square flown from a mast indicates that a right-hand circuit is in force."

If it's two feet *rectangular*, of course, you do a left-hand circuit.

● Advertisement in the journal of the Dutch Association of Airline Pilots, as quoted in BALPA's *The Log*:—

"For sale: First Class Nav. Licence No. 56/20 dated April, 1960, for cash, or part exchange old tennis racket."

● Wise words from Dr W. Berchtold, president of Swissair, which, as you know, is now in partnership with SAS:—

"Hard and fast rules for this co-operation have been avoided on purpose; no general high level instructions are issued . . .

"By growing organically, by gathering experience step by step we want to avoid friction, inflexibility and other difficulties; forced and hasty decisions are prevented wherever possible . . .

"This gradual progress is in accord with our fundamental concept of each partner's freedom. If it can be so expressed, the SAS-Swissair relationship is based on federal principles and not on centralization. What is to be done jointly has to be expressly agreed in advance; thus neither partner feels himself to be under any compulsion. Both with the Scandinavians and the Swiss this philosophy stems from their long tradition of liberty. In practice it means that both managements retain their full responsibilities. Co-ordination is achieved through direct discussion and agreement, often through working groups, not through a central organization with its own powers to issue orders like a kind of Supra-Management or Supra-Board of Directors."

● *"If all turbine aircraft to date had been designed with their engines mounted on the rear fuselage and then some designer or other had come to us with a proposal to mount engines on integral fuel tanks, we would have had very serious misgivings indeed at this idea."*—Attributed by Mr D. J. Lambert of Vickers to "one of the English-speaking airworthiness certification authorities."

● "While taxying to take-off, the pilot—for an unknown reason—changed his mind and tried to land. The Commission cannot ascertain his reason. We suggested on October 15 that his warning light may have gone on."—*From the Kayhan International Tehran Daily, October 27.*

● On the front cover of the November 1960 issue of *BEA Magazine* is the photograph of their Majesties King Mahendra and Queen Ratna of Nepal, taken on the occasion of their arrival at Gatwick by BEA Viscount on a State visit to this country.

You may recall this particular picture (*Flight*, October 28, page 684), and also this column's regret that no one had bothered to clean up the oil-besmirched airport apron to make it fit for their Majesties' reception.

I am glad to say that in the photograph reproduced by BEA not a trace of oil is to be seen. The nation's dignity has been restored by the retouching brush.

● The Neiman Marcus store in Dallas, Texas, has, in its Christmas catalogue, "His and Her airplanes." His is a Beechcraft Super 18 costing $150,000. Hers is a Beech Bonanza at $27,000.

● My acknowledgments to *Intercom*, BEA flying staff magazine, for this one:—

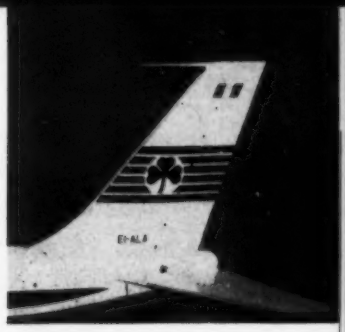
"If you can keep your head when all about you are losing theirs, then you just haven't assessed the seriousness of the situation."

ROGER BACON

On the extreme left, comrades, is the scene in Red Square Moscow, on November 7, 1960, the 43rd anniversary of the Revolution. But I say, what's happened to the balloon? Has it gone off pop? And why do the engines of those surface-to-air missile launchers suddenly appear to be in need of a rebore? Ah, a clue—the tree. There's quite a difference in growth evident in the two pictures. Three years in fact, because the right-hand picture shows the scene in Red Square on November 8, 1957

PROGRESSIVE AIRLINE

PROBLEMS AND PROSPECTS OF AER LINGUS—PART 2



BY GARRET FITZGERALD

THIS is the second and concluding instalment of an article by the economic adviser to the Irish air companies. Part 1 appeared in "Flight" for November 11, pages 753-4. This penetrating analysis of a relatively small airline's approach to air transport first appeared in serial form in the "Irish Times."

THE good fortune of Aer Lingus is not confined to the high proportion of its routes on which it carries all or most of the available traffic; it is also well placed in the number of Fifth Freedom rights which it possesses. These are rights to carry traffic between two foreign countries—e.g., Aer Lingus's right to carry passengers between Lourdes and Rome—and they are normally accorded only when the countries concerned seek and are given similar reciprocal rights.

Aer Lingus might well have found itself with very few rights of this kind, because Ireland has so little to offer European airlines, by way of reciprocal rights. Indeed, the only equivalent right open to the Irish Government to cede in return for intra-European Fifth Freedom rights is the right to carry traffic between Shannon and North America. Unfortunately, some European airlines are for geographical reasons completely uninterested in such a right—notably the national airlines of Portugal, Spain and the Scandinavian countries—while the interest of others is relatively slight. Thus, for example, BOAC did not exercise its transatlantic Fifth Freedom rights at Shannon between 1952 and the beginning of last summer, and even today its interest is extremely restricted. Air France has had only a limited interest in Shannon - New York traffic for a brief period during the past decade. And the remaining European companies serving the North Atlantic route last winter temporarily lost such interest as they had had in Shannon, although some of them have since returned.

Rights Obtained. In these circumstances it might have been thought that Aer Lingus's chances of obtaining intra-European Fifth Freedom rights would have been very slight, but in practice the company has obtained all the rights required to assist its now extensive network of Continental services, with one partial exception (on the Dusseldorf - Copenhagen sector it can pick up or set down only those passengers who are stopping-over at Dusseldorf *en route* to or from Manchester or Dublin).

This means that although Ireland's Fifth Freedom bargaining power is probably weaker than that of any other European country except Scandinavia, the Irish Government has succeeded in winning for its national airline a higher proportion of the Fifth Freedom rights required by this company than virtually any other European government has obtained for its national carrier. This achievement reflects considerable credit both on the Irish Government's negotiators, and on the exceptionally close co-operation between national airline and Government aviation authorities, but it also reflects in practical form the immense goodwill which both Ireland and its national airline have won for themselves in Europe. Time and again Ireland has obtained from the most restrictively inclined of European governments concessions which no other country would have obtained without a substantial *quid pro quo* —and the motivating force behind these concessions has been goodwill towards and respect for Ireland and Aer Lingus.

Although Aer Lingus is so well placed among European airlines in the matter of competition from other airlines, therein lies a real danger. For its advantages in this respect having been acquired not as of right, but through tapping the fund of goodwill that exists towards this country, or through a fortuitous and possibly impermanent lack of interest abroad in the potentialities of the Irish market, may at any time be eroded by a change in any of these factors. Indeed, so far as Britain is concerned, the existing agreement provides for the gradual erosion of the advantages possessed by Aer Lingus in respect of its share of the traffic on the three major routes jointly operated with BEA.

Thus Aer Lingus cannot face the future with complete security, or even with a reasonable expectation that its rate of traffic growth will be comparable with that of other European companies for, as time passes, more and more airlines are bound to want to operate services to Ireland, taking a substantial share of any traffic growth that may occur in the years ahead. In particular, Aer Lingus has to face the revision of the Anglo-Irish bilateral agreement two years hence. (Under the terms of the 1956 agreement, BEA's initial share of the traffic on the London, Birmingham and Manchester routes was 20 per cent, three-quarters of any increase in capacity required thereafter to be furnished by BEA, and one-quarter by Aer Lingus. BEA has not, however, taken up any of its share of Dawnflight and Starflight services on the London route; it has limited severely its participation in the Manchester route; it has not taken up any of its share of the Liverpool route; and the agreement confines its operations on the Birmingham route to the summer months.)

This uncertainty, and the probability that its rate of traffic growth will be relatively slow in the years ahead, must necessarily exert a considerable influence on the airline's future planning, and the importance which the management of Irish Air Lines has attributed to the transatlantic route as a source of new traffic for the company's European network must owe something to this natural concern about the prospects of future expansion within Europe.

In facing up to increasing competition in Europe, however, Aer Lingus has one notable advantage—that the great majority of its passengers are Irish, or of recent Irish origin. On cross-Channel routes, it is true, the bulk of the traffic originates in Britain, but about one-half of this traffic consists of Irish people returning home for holidays in their own country. On Continental routes, with few exceptions, the traffic is predominantly of Irish origin —on some routes, indeed, almost exclusively so; this may have been an important factor influencing the failure of Continental airlines other than KLM (and for two brief periods Sabena) to exercise their rights to operate services into Dublin.

Coach-Air Service. What other favourable factors may help the company in the face of the difficulties that may be ahead? First of all there is the coach-air project to Anglesey, if the difficulties that hitherto have impeded this operation can be overcome. But important though this operation will undoubtedly be as a source of new traffic, it is unlikely in the nature of things to earn a high rate of return, for its success depends on its operation at the lowest possible cost and the lowest possible fare.

A second source of new business, which is currently developing with great speed, is the chartering of series of flights to tour organizers—whether they be travel agents, coach-tour companies or holiday-camp owners. Several Aer Lingus aircraft are already being kept busily employed on this work, and more may be needed in future years.

Cork Airport. Thirdly, the opening of Cork Airport in 1961 will provide the company with a welcome new source of traffic. The Cork area is of growing importance as an industrial centre, but it is also the gateway to one of Ireland's major tourist areas —West Cork and Kerry. Undoubtedly, Cork will be linked with London by a daily service, although under the terms of the Anglo-Irish air agreement of 1957 such an operation, of course, may have to be shared by Irish Air Lines with a British company. Other services may be expected to radiate from Cork to Bristol and/or Cardiff, to other British provincial cities (at any rate indirectly through Dublin), and, in the summer months, to certain points on the Continent, such as Paris, Lourdes, and points beyond Lourdes, such as Barcelona. To some extent these services will divert traffic from existing Aer Lingus routes, but past experience would suggest that for the most part the traffic carried will be new to air transport, and many of the passengers, indeed, may be people who would not otherwise have travelled at all.

Traffic Peaks. A fourth opportunity for improving the economy of Irish Air Lines' European services will be afforded by the remarkable dovetailing of the European and transatlantic peak travel periods. On the North Atlantic route a period of just under four weeks divides the end of the inbound peak period from the beginning of the outbound peak when the American visitors start returning to their homes after their European vacation. During this four-week interval the demand for seats in either direction on the North Atlantic route drops sharply—and this is especially true of the traffic between North America and Ireland, which to a greater extent than traffic between North America and any other European country is subject to severe fluctuations.

This four-week period coincides precisely with the extreme peak period in Anglo-Irish travel, when Aer Lingus always has had difficulty in coping with the demand for seats on routes between Britain and Ireland. By temporarily transferring one of the three Boeing jet aircraft to the European network—most

One of the Irish Air Lines' three Boeing 720s

PROGRESSIVE AIRLINE . . .

probably to the Dublin - London route—the company would be enabled to cope more effectively with this peak traffic while simultaneously releasing turboprop aircraft to handle increased traffic on other routes—such as, for example, the new routes from Cork which, by a happy coincidence, will be inaugurated shortly after the delivery of the jets. The economy to be effected by this integration of the European and Atlantic fleets of Irish Air Lines might well be of the order of £100,000 p.a.

Finally, just as the transatlantic service will draw much of its traffic from the European network, so also the company's European routes can hope to an increasing extent to benefit from the new traffic being fed into them by the transatlantic service; already this service can be seen to have become a source of significant additional revenue to Aer Lingus, and with the anticipated trebling of the transatlantic service's initial loads by 1961, when the jets are introduced into service, the contribution to the European network from this source will be of major importance.

Thus, while Irish Air Lines' European network is faced with a somewhat uncertain future, there are at any rate a number of favourable as well as unfavourable influences at work. Moreover, it must not be overlooked that the operational economics of the European network are bound to improve in the years ahead, as traffic expands, because this network has just been re-equipped with two fleets of the most modern medium-haul aircraft which, having been designed to serve the company's needs for many years to come, are at the outset slightly larger than most of these routes at the moment require. As the years pass, large increases in traffic can thus be handled without commensurate increases in the frequency of operations and, as load factors rise, economy will improve considerably—if overheads can be kept down.

Jets in Europe. As the years pass the growth of jet operations *within* Europe may face Irish Air Lines with a serious competitive problem; the extent of this problem will depend, of course, upon the degree to which it succeeds in maintaining its present large measure of freedom from competition on its European routes. If this problem became serious, however, it would be open to the company to meet competition of this kind by using its transatlantic jet aircraft on intra-European routes. Unlike all the other transatlantic air companies, Irish Air Lines is equipping itself with a type of jet aircraft which is suited for these intra-European operations as well as for the North Atlantic route. But with a fleet of only three Boeing 720s it is difficult to envisage the operation by the company of jet services within Europe on a year-round basis; during the busy peak periods on the North Atlantic the three aircraft may be required on this route to provide a regular service backed by a reserve aircraft.

However, by the time that jet competition becomes acute on Irish Air Lines' European routes, the company's transatlantic service may well have proved itself to be a remunerative undertaking, and a proposal to purchase a fourth jet, with a view to supplementing the transatlantic peak frequencies as well as substituting jet for turboprop operations on the more competitive intra-European routes, might command general support as a worth-while money-making investment.

Aer Lingus operates seven Fokker F.27 Friendships

SOPWITH'S FIRST DECADE

(continued from page 839)

Sir Thomas started his own aircraft firm about the time of the Military Trials in 1912 and records that "undoubtedly our greatest success before the Kaiser's war came in August 1914, was the Tabloid, which first flew towards the end of November 1913. It was called the Tabloid because it was compact and small. But Tabloid was the registered trade name of a tablet marketed by Burroughs Wellcome, who took a dim view of the naming of our aeroplane, so we had to abandon the name—officially. But the name stuck and thereafter several small aeroplanes made by other firms were also nicknamed Tabloid, much to the indignation of Burroughs Wellcome, who could not do anything so long as the name was not official—except perhaps take their own Tabloids as sedatives.

"Our Tabloid, which was renamed the Scout, was but 20ft long with a span of 25½ft. It had an 80 h.p. Gnome and carried pilot and passenger with fuel for 3½hr.

"Within a few days of its first flight—things were done much more quickly in those days of wood and canvas—Hawker flew it to Farnborough and astounded everyone by climbing with pilot, passenger and full fuel to 1,200ft in one minute, with a top speed of 92 m.p.h. and stalling at 36 m.p.h., a greater speed range than any aeroplane at that time.

"Later it was converted to a single-seater. The first production Tabloids had wing warping, but were fitted with ailerons before production got very far. In that form it officially became the Scout and was to be the most successful single-seater Scout in the early days of the Kaiser's War."

Sir Thomas refers to the Sopwith Pup—"many pilots of those days still look back to the Pup with nostalgia and say it was the loveliest aeroplane ever to fly"—and to its predecessor the One-and-a-half Strutter: "three flew as seaplanes just before the Pup and about 6,000 were built as landplanes." He records that the Sopwith Co was wound up in 1920 and the Hawker Co brought into being. "It was our intention to keep it small, but things happen and look at the damned thing now."

OFF THE GROUND

(continued from page 847)

with the direction of flight. To turn left or right momentum must first be arrested by leaning well back to destroy the inertia, inclining one's weight in the new direction to be followed and adjusting the position in which the platform is pointing by judicious application of the handlebars. A few tweaks of the vanes seem to be more successful than applying full lock and thus completely deflecting the airstream.

After a number of failures, when I had to admit defeat and kill the lift by closing the throttle, I managed a couple of uncertain left-hand circuits of the lawn, with the Hoverscooter pointing for the most part in the direction I wanted it to go. It was some consolation to me that Carl, who rides higher because he is lighter and has become quite a skilled Hoverscooter conductor, found similar difficulties in controlling unwanted rotation or in harnessing the inertia to skim in the right direction—most runs came to an end when attempts at steering ended in an unwanted and uncontrollable rotation or the scooter slid off the end of the lawn.

Amusing toy or genuine development vehicle? I think the days have passed when laughter was the only reaction to something new and relatively unsuccessful. Rhodes certainly intend to develop the AirRhoCar to a state where it can be offered for commercial sale to duck hunters and other sportsmen, but before then a good deal of development will be needed. The basic snag seems to be that there is no separate propulsion unit to take the place of centre of gravity control. This ground-effect vehicle cannot really be steered properly, cannot surmount any gradient and is limited in hoverheight. It is probably also too small ever to be fully effective. But it is a remarkable lesson in what can be done cheaply and simply; and, although I do not myself believe that there will ever be a hovercar for Everyman, I'm very glad to learn that practical development is going on at the smaller end of the scale. It *could* lead down an avenue that is as yet unexplored—short take-off not down a runway but by accelerating a semi-conventional aircraft off a cushion of air.

AIR COMMERCE

Here on a pre-delivery test flight over the Californian coastline is one of KLM's seven DC-8-30s. The first article on this page records—with the frankness that is almost exclusive to the American aircraft industry—some of the problems that have attended the development and operation of this jet transport

DC-8 DISCUSSED

SOME useful information about the DC-8 was revealed recently by two representatives of Douglas. Speaking before a Los Angeles gathering of the SAE on the subject of *The Penalties of Non-Optimum Flight Operations of Jet Aircraft*, Mr A. C. Butterworth—who is director of market research and sales engineering at Santa Monica—observed that in the "good old days" before the advent of preferential runway and noise abatement procedures and so forth, it had been correctly established that the optimum flight-path for a turbojet transport was a simple "cruise climb" procedure. Deviations from this kind of flight operation were, however, now inevitable, and it was interesting to examine the economic penalties being paid by the airlines for non-optimum procedures.

A major penalty was incurred to takeoff. Recently the speaker had experienced a take-off delay because no fewer than 17 jets were waiting in line ahead. The fuel used during this delay was, he said, sufficient for a transatlantic flight of any of the long range jets.

Departure control had presented other problems. It was not unusual for eastbound jets (out of L.A.) to head west out over the Pacific and consume 3,500lb while performing a climbing turn before re-crossing the California coast at some 27,000ft. By comparison, the DC-7 bound for New York burned only 600lb before heading east.

Severe penalties were also incurred during flight across the American continent. On today's crowded airways it was becoming increasingly more difficult to secure an optimum altitude. The startling sum of 9,600 extra pounds of fuel were used if the flight were made at, say, 25,000ft instead of 30,000ft. Speed was also an important economy factor. Maximum range was obtained at M.75. At a velocity of M.85 fuel consumption rates rose by over 15 per cent. The difference in fuel consumed between operations at M.83 and .84 was an astonishing 5,100lb.

Arrival procedures at destination also produced penalties. Holding over destination required 2,000lb for each 10min of lost time. And an often overlooked fact was that it costs fuel to carry additional fuel. On long distance flights it sometimes became necessary to carry 620lb for each 1,000lb of contingency fuel.

Mr O. R. Dunn of the Douglas company gave a highly commendable account of the DC-8's early flight problems in a paper entitled *Flight Characteristics of the DC-8*.

Much design effort had, he said, been spent on optimizing the wing. And, basically, the wing as such had met all its intended performance characteristics. Unfortunately, interference effects occurred around the nacelles and pylons. Cambering the pylons alleviated this problem to a degree, but C_L max losses associated with the pylon effects nullified much of the lift coefficient gains inherent in the basic wing. Further investigations led to the incorporation of leading edge slots. The desired results had been achieved, and the DC-8's stall characteristics with slots open were essentially those of the basic wing. There was now no tendency to dig in or pitch up as the stall approached; recovery from stalls was prompt, and was characterized by a positive pitch down. No special techniques were required for stall recovery.

Initially, the tail had been designed with a single long-span control tab on each elevator. Early flutter trials indicated that the long free tab adversely affected flutter characteristics and, since a much smaller tab would not aerodynamically drive the elevator to full travel under critical control conditions, some solution other than a simple long or short tab had to be found. The simple answer was to split the tab into two. The inboard section was retained as the control tab and its mechanical advantage was halved. The outer tab was converted to a geared tab which approximately matched the motion of the original tab under critical manœuvring conditions. The resulting configuration proved highly successful from the start.

The large DC-8 rudder provided excellent cross-wind landing characteristics, but in so doing introduced a lateral control problem. Here the wind tunnel results had proved over optimistic. Insufficient lateral control was available to utilize the full effectiveness of the rudder—an intolerable situation. Excessive aileron deflections were hence required to cope with the cross-wind landing problem. Further study revealed that a higher-than-anticipated wing dihedral effect was responsible for the trouble; however, it was obviously impossible to change dihedral at that late date. Ultimately, the problem was solved by adding a lateral control function to the spoilers.

The basic DC-8 wing, according to Mr Dunn, had been designed for operation at lift coefficients of 0.3. Flight tests verified the analytical estimates; but at the still higher coefficients employed for long range flight induced drag was greater than anticipated. Considerable effort was expended to correct for the loss in specific range. The solution was to revise the wing tips. Although it had been rumoured that the extended tips had been added to increase aspect ratio, the sole reason for this revision was to decrease the wing's effective sweep at the tip. Changes in the wing leading edge were also incorporated to improve the DC-8's range. As a result of these improvements, specific range had been improved by 8 per cent, with a corresponding decrease in operating cost of some 2½ per cent.

ANOTHER ALTIMETER ACCIDENT?

IT has not proved possible to determine with certainty the cause of the accident on June 10 to a TAA Friendship. Twenty-five passengers, two pilots and two stewardesses were killed when the aircraft crashed into the sea 7½ miles south-east of Mackay Airport, Queensland, whilst approaching to land. But the Australian Department of Civil Aviation investigators suggest that misread altimeters might be the most likely explanation. They are continuing two lines of investigation into: (1) the effect of water in the F.27's pitot static system, and (2) possible "abnormal bending" discovered in the crashed F.27's pitot static piping. Meanwhile special altimeter cross-check procedures have been introduced for F.27 descents, together with a requirement for blowing through F.27 pitot static lines with compressed air. Mr Lunn, the director of the investigating teams, says in an introduction to his thousand-page report: The circumstances strongly suggest that the aircraft descended under the control of the pilots and that for some reason which remains obscure they did not become aware of the dangerously low height at any time, or at least not until it was too late to prevent the aircraft striking the water."

Mr Lunn says that the world-wide history of accidents provides good grounds for admitting misreading of an altimeter as a possible cause for this type of accident. He continues: "The lack of direct evidence either to support or refute such a proposition in this accident prevented any advance beyond the point of merely con-

AIR COMMERCE . . .

ceding the possibility. In the light of all physical evidence obtained and the circumstances apparent in the accident, the possibility that either one or both of the pilots were motivated by erroneous information obtained from their instruments seems to be the most tenable." The fatal accident concerned was the first ever to be suffered by TAA. The fatal Austrian Airlines Viscount crash in Moscow on September 26 last is also officially classed as a possible altimeter accident.

THOSE FORMS

PERHAPS it is the last part of a Written Answer to a question in the House of Commons last week that provides the real reason for the proposed arrival and departure forms (*Flight*, September 30, page 550). The cards would, says Mr N. Macpherson, for the Board of Trade, provide information "about immigration into this country of people from other parts of the Commonwealth." In other words—it might be deduced—these cards will provide the Government with a check on the amount of coloured immigration into this country. The full reply was as follows:

"This matter is still under consideration. If an Order is made, a simple card would be introduced to be completed by British subjects travelling on the long air routes between the United Kingdom and countries outside Europe only. The cards would assist in our estimates of balance-of-payments credits and debits arising from the movement of tourists and migrants, provide information about emigrants from this country, in particular about the loss to this country through migration of skilled people, and about immigration into this country of people from other parts of the Commonwealth."

BACK TO BURBANK

THE ten Electras operated by Australian operators—Qantas (four), TAA (three) and Ansett-ANA (three)—are to be returned to Lockheed at Burbank for their modifications progressively as from the beginning of December. As is the case with other Electra operators, the cost of the modifications is to be borne by Lockheed. The Australian operators expect that their aircraft will each be in the Lockheed factory for about 20 days, and all ten are expected to be modified by June 1961.

The changes, it will be recalled, involve increasing the stiffness of the powerplant mounting structure and the wing. The speed restrictions imposed on the Electra will not be lifted until the Australian Department of Civil Aviation is "completely convinced of the efficacy of the modifications," and Australian airworthiness personnel from the Department of Civil Aviation are to visit Lockheed with one of the first Electras to evaluate the Lockheed calculations and tests. But, according to the Minister for Civil Aviation, Senator Shane Paltridge, "I am satisfied that Lockheed have done everything possible to find . . . modifications which will make the Electra completely safe at the higher speeds."

Footnote: On November 15 Braniff filed a suit at Dallas, Texas, for $2.4m damages from Lockheed on the grounds that the Electra was "negligently and carelessly planned, designed, and manufactured."

ABBOTSINCH IT IS

BY no means universal approval greeted last week's announcement in the House by Mr Peter Thorneycroft, Minister of Aviation, that Abbotsinch and not Prestwick will be the new airport for Glasgow when Renfrew closes in three years' time.

Mr Emrys Hughes referred to Abbotsinch as "a potty little airport," and asked the Minister if he realized he was making a very short-sighted decision when such a large sum of money had been spent on Prestwick. "Not everyone in the west of Scotland will find it convenient to go to Abbotsinch," was the opinion of Mr Ross, who added: "Indeed, not everyone in Glasgow will find it so convenient." He asked if the Minister would consider the idea of having some services from Prestwick run by BEA. The Minister was also asked if he was aware that "there is a feeling now in Ayrshire that you may have been misled by Sir Patrick Dollan and his advisory council in Glasgow." And he was reminded that London Airport is the same distance from central London as Prestwick is from Glasgow and that the time could easily be halved by a rapid diesel service. Furthermore, the questioner added, would the Minister remember that Prestwick was still the most fog-free area in the British Isles?

In reply, Mr Thorneycroft said that, in BEA's view, the interests of internal passengers were better served by using an airport nearer Glasgow than Prestwick, but any operator could apply for a licence. He had had some "fruitful" discussions with the Ayrshire county council over Prestwick and was glad to have its views. "I should like to pay tribute," he added, "to the county council's initiative in developing this magnificent international airport."

The present main runway at Royal Naval Air Station, Abbotsinch, is 5,820ft long. It is to be extended by 900ft to the north-east, and this will provide an effective length of 6,000ft. The length of the main runway at Renfrew is 5,700ft.

TOWARDS REDUCED SEPARATION

BRITAIN, Canada, Ireland and Portugal have been invited by the US Federal Aviation Agency to participate for a period of one year in a North Atlantic air traffic survey aimed at the eventual reduction of separation distances. Information will be obtained by random sampling at various air traffic control centres of peak-day traffic over the North Atlantic routes. Each centre will serve on a monthly basis as a peak-day co-ordinator of all the work and from this it is hoped to obtain a complete picture of North Atlantic traffic at the end of the first year. This will include identification of every aircraft, its progress along the route, altitude, departure and arrival times at the boundaries of each Oceanic Area and information designed for use in the computers which will be used to find solutions to the various problems as they are recognised.

Present North Atlantic minimum separations are 30min longitudinally, 120 miles laterally, 1,000ft vertically up to 29,000ft and 2,000ft vertically above 29,000ft.

BOEING SUPERSONICS

A SIZEABLE design team, headed by L. Goodmanson as project engineer, is now planning a supersonic airliner at Seattle, reports a *Flight* staff member who was there last week.

Broadly, Boeing are aiming at a steel aircraft for speeds between M2 and M3, a payload about equal to that of the 707, a gross weight of about 400,000lb, and a still air range of 3,700-3,800 n.m. There is no question of VTO performance, but Boeing are definitely aiming at landing speeds the same as, or lower than, those of the 707. An effort will be made to hold angle of attack on landing to a reasonable value in order to facilitate pilot control. There are real prospects that a steel structure can be reasonably cheap—or rather not unreasonably expensive. The powerplant will comprise large turbofans of relatively low pressure ratio with additional combustion aft of the fan section—a form of afterburning. Both P & W and G.E. have shown an interest in such engines and their performance is increasingly attractive the higher the cruising speed. There are also advantages in economy at "loitering" speeds and subsonic performance remains outstanding. Additional combustion would not be used on take-off, in order to reduce noise—and it would not be needed because of the inherently high thrust/weight ratio.

Boeing see no advantage in lower speeds. At M1.5, for example, the L/D *versus* Mach curve is at its worst point and an M1.5 airframe cannot reasonably be stretched beyond M2 because of temperature rise. M1.2 is interesting because of the ability to avoid sonic boom problems, but area ruling would tend to make the airframe extremely hard to stretch.

The ability to stretch the basic aircraft is considered most important and for this reason pod-mounted engines and parallel-sided fuselage sections are attractive—as they have been in the 707. Steel structure is considered to be an important sales point for both manufacturer and airline. The aircraft will be capable of speed increases up to M3, but it is most unlikely that such a speed will be used for many years, if only because of the problems in equipment reliability at the temperatures involved. Aluminium alloy will

"The Flying Sherpa" is the class name of the Air-India Super Constellation freight service inaugurated on November 17 between London and Bombay. The airline now operates three L.1049Gs converted to cargo configuration by Lockheed Aircraft Service. (A note on Mr Tata's RAeS Commonwealth lecture appears on page 855.)

Montreal, November 16, 1960: the first swing-tail Canadair CL-44D (four Rolls-Royce Tyne 515s of 5,730 e.h.p.) on its maiden flight. The fairings for the stout swing-tail hinges indicate where the swing-tail opens. The fuselage will accept payloads of up to about 66,000lb in units measuring 11ft by 6¾ft. Seaboard & Western placed an order in May 1959 for five CL-44D4s, plus an option of five; Flying Tiger in the same month ordered ten; and in May this year Slick ordered two. The first of these big commercial freighters is due to begin scheduled services within a year's time

according to Boeing, be unusable for structure in contact with the airstream at speeds above about M2.1. Another argument against M3 is that this speed will save only 40min over an M2 flight from New York to London.

Cruising at M2, one supersonic airliner carrying the same payload as a 707 will have a block speed of 900kt—about twice as fast as a 707—and will do 15 per cent more flying hours. It will be attractive on sample PanAm routes because it will "fit the clock" and allow really convenient scheduling.

Boeing have naturally considered the economics of the supersonic airliner and state that these can be realistically reckoned at about 15 per cent above those of the 707. One estimate even makes the costs the same.

The range quoted above is intended to make the airliner capable of flying from the eastern seaboard of the US to centres well inside Europe non-stop—Copenhagen, Frankfurt or Rome for example—regardless of winds. There is a range and speed economic limit beyond which size becomes unprofitable for a given payload.

The aircraft will cruise supersonically only over sea and would make a small part of its journey at subsonic speed over land, for example, across France to Rome after crossing from New York. The problem of shock-wave trailing over a 50-mile-wide swath of countryside is intractable, as has already been realized from supersonic flights made by military aircraft. The progress of a B-58 making a supersonic test penetration of Norad area to Milwaukee could be clearly tracked by the swamping of successive telephone switchboards by callers notifying all manner of strange and improbable disasters. One of the main public relations problems is to make people recognize a sonic boom so that they won't think that something—their central heating boiler in US society—has blown up.

A low-level supersonic pass is definitely destructive. A B-58 pass at M2 at about 40,000ft is extremely noisy but little more. A boom is double because of the initial pressure rise and subsequent recompression of the air, spaced about 0.5sec apart. Pressure rises up to 1lb/sq ft on the ground are disturbing and often mistakenly identified as accidents, but do not cause damage. Between 1 and 3lb/sq ft is objectionable. Boom intensity is partly according to the volume of the aircraft and partly according to the lift being generated. The second factor has not hitherto been important, but will now make a major contribution in supersonic airliners because L/Ds of 7 and 8 or even 10 are being sought. These could by themselves cause a 2lb/sq ft pressure rise in the boom at ground level.

On one occasion the pressure rise was actually measured as a boom struck two plate glass windows, each measuring 5ft by 10ft. One window cracked across with a rise of 1.75lb/sq ft. The other remained intact. The boom will not affect ships because their structure and windows are much stronger, but the disturbance to people will remain a problem. Pressure rises between 2 and 2½lb/sq ft will not damage the ears.

Two factors are considered definite by Boeing. The airlines cannot afford to be liable to damage claims from supersonic flying; and neither can they tolerate having to operate in specific corridors. Supersonic booms may be felt 25 miles either side of the aircraft's track and wind can alter the distribution, but the higher pressure rises will occur only over a 10 mile-wide band.

Finally, Boeing appear to be a little sceptical about the possibility of co-operating with European companies in designing a supersonic airliner, mainly because of the obvious commercial implications. But they feel that all the problems can be solved and think a suitable communications system for effective technical liaison could be developed. They insist that design leadership would have to be firmly vested in one company.

JET SPEEDBIRD WEST AND EAST

(Continued from page 835)

Descent to begin at 0852 and to last 24 min at mean TAS of 364kt, using 800kg fuel. Engineers plan pressurization management between bleeds and turbos when throttled back on descent. ETA London 0916Z with 19,000kg of fuel remaining at 1,000ft.

The tip of Ireland is painting well on radar at 60 miles. Sun is blinding. A leaden sea visible between dollops of cloud thrown almost up to our level in polar maritime cold air. IAS 250kt; M0.82; r.p.m. 88 per cent; o.a.t. −48°C; cabin height 6,000ft. Navigator hands time plot to co-pilot and relaxes slightly. HF weather reports in French. Cillard RAF radar (in Scotland?) has us. English voices, clipped and calm in welcoming efficiency.

0820Z: Ireland in sight. Centre and reserve tanks now dry, remaining fuel distributed in wings. 0837Z: Cillard loses us and we switch to Scottish Airways control. Estimate Isle of Man at 0843. Prepare-for-descent checks read out. Landing weight will be 77,500kg—very light—VREF 126kt, target threshold speed 135kt, maximum threshold speed 149kt.

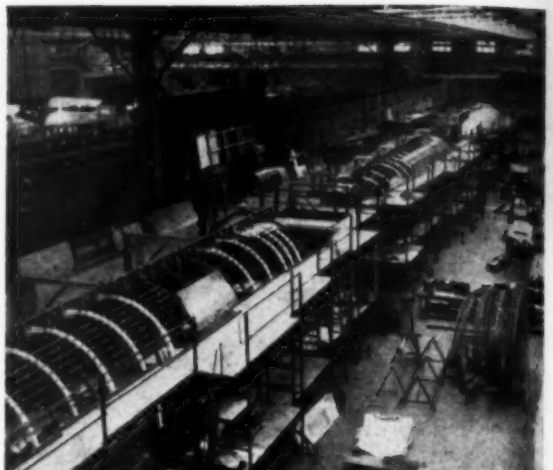
0842Z: Pass Isle of Man, in sight below, together with coasts of Wales, Ireland, England and Scotland, and request descent clearance for 0851. At 0846 cleared down to flight level 210 and call Preston. Throttle outers to 68 per cent and inners to 87 per cent r.p.m. Descending at M.O.68 at 700ft./min. Wallasey at 0853.

0900Z: The Pennines lava-like in valley fog and snowy tops. Joddrell Bank telescope like a deployed parachute far below. Atlantic charts and manuals being cleared away. Pass Lichfield, estimating Daventry at 0907, tuning beacons, change to London control. 250kt i.a.s., jolted in rough air. Daventry at 0907, estimating Beacon Hill at 0913. Cleared to flight level 190. Watford on No 1 ADF, Dunsfold on No 2 ADF. Find Beacon Hill by Flying Dunsfold range leg to a bearing from Watford. Under London radar surveillance from Daventry. Cleared to flight level 080. Don't confuse Beacon Hill with Woburn, check with ADF. 1,000ft/min now at 150. Wheels rumble down for airbrake effect, slow to 200kt at 2,500ft/min; trying to make Watford at 8,000ft.

Over Watford at 11,000ft radar takes us straight on to a southerly lead-in for ILS, asks our rate of descent. Runway visibility 1,500yd. Still on autopilot, in cloud. Flap coming down. See Greenwich through a hole in cloud, then Crystal Palace. A helicopter is reported leaving Battersea. Approach checks read. Autopilot-coupled glide-path and localizer armed. Radar vectors us on to centre-line. Speed coming back to 150kt at 3,200ft. QNH set on co-pilot's altimeter, QFE on captain's. Height 2,100ft, glide-path coupler engaged at 152kt, going down at 900ft/min into dull mist. Melted frost dripping fast from window frames. Captain's hand poised on control wheel. Windscreen wipers working hard. Lead-in lights now dimly in view, but no trace of runway.

BEA engineering base comes into sight to our left, co-pilot postively identifies runway and tells captain. We surge in past the lights, the captain cuts the autopilot and holds off. When I think we are still 100ft up, the main wheels touch smoothly, the nose comes down, spoilers are popped out, reverse thrust pulled. Further end of runway still out of sight. The captain takes the nosewheel tiller and starts braking while the co-pilot holds the column forward and calls the decreasing speeds down to 60kt. We turn off with some runway to spare, switch to airfield control frequency. Shutting down checks begin. We are home.

Chock-to-chock time 9hr 15min for 4,210 n.m.: we took off at about 1700 hr Seattle time and it is now 0130 by that reckoning—time for bed. But here in London it is 0900hr or so and a new day is just beginning. This is the way to travel if you don't weaken.



The recent fire at A. V. Roe's factory at Chadderton has not affected production of the 748, and the first aircraft off the line is due for delivery to Skyways in time for their peak summer services next year. This new picture shows progress with the first batch of production 748s. The first prototype Avro 748, G-APZV, now has 180hr in its logbook

AIR COMMERCE . . .

QANTAS IS 40

LAST week Australia's international airline, Qantas, celebrated its 40th anniversary. One of the two men who founded the company, Sir Hudson Fysh, is today still actively in harness as chairman. He will, in September 1961, be the host in Sydney to the annual general meeting of the International Air Transport Association.

Qantas—originally Q.A.N.T.A.S., or Queensland and Northern Territory Aerial Services—began operations on November 16, 1920, doing charters and demonstrations. It got an airmail contract and a government subsidy to operate regular services in eastern Australia, which were gradually extended until 1934 when, joining up with Imperial Airways as Qantas Empire Airways, it progressively concentrated on international routes. It was in 1934 that the partnership that exists today on the Kangaroo route was inaugurated. The whole of this route was not actually operated by Qantas until after the war when, in July 1947, the Australian Government bought BOAC's interest in QEA.

Today Qantas is BOAC's most valued Commonwealth partner, the latest cementing of the partnership between the two airlines being the tripartite pooling agreement covering the eastern routes in association with Air-India. An account of this agreement appeared in *Flight* for October 14, page 623.

FOREIGN AIRLINES AND THE MINISTER

"PLEASE leave us alone," Mr W. A. Kermer, UK manager for KLM asks the aircraft manufacturers. "We will buy your jets—we will see to it, through financial manipulations, that you get your money. But please give us a chance to make a meagre profit with the aeroplanes we operate today and the ones we have ordered."

This was said by Mr Kermer at a luncheon of the Foreign Airlines Association in London last week. Then, addressing the Minister of Aviation, and speaking for all the foreign airlines who use UK airports, he went on: "I would like to appeal [to the Ministry] to reconsider their recent decision to increase the landing fees by approximately one-third as from April of next year. It is apparently felt that the corporations and foreign airlines should be called upon to meet the losses on the operation of the UK airports without taking into account the community benefits arising from the existence of airports in the country, particularly international airports. In my humble opinion, the Government should absorb a large proportion of the costs because of the benefits derived." He said that these increased landing charges might, for some of the airlines, mean the difference between profit and loss.

The Minister's reply was to the effect that, though there was a case for subsidizing the airline industry when it was in its infancy, it was grown up now. Airports had—like the airlines—to make ends meet. They could not (echoing his words to BIATA the previous week) be run as a branch of the welfare state.

SILVER CITY'S NEW OVERSEAS VENTURE

AT Gatwick Airport last week, Silver City made known their new venture into the field of ground radio-aid calibration and testing. They have been awarded a five-year contract by the Ministry of Aviation to take over from the Ministry's agents—the FAA calibration unit at Beirut—airborne radio-aid testing at Commonwealth airfield sites in the Middle East and in Africa. It is believed that this is the first contract for a calibration service ever to be awarded to a private company, and it is certainly the first to be issued by the MoA.

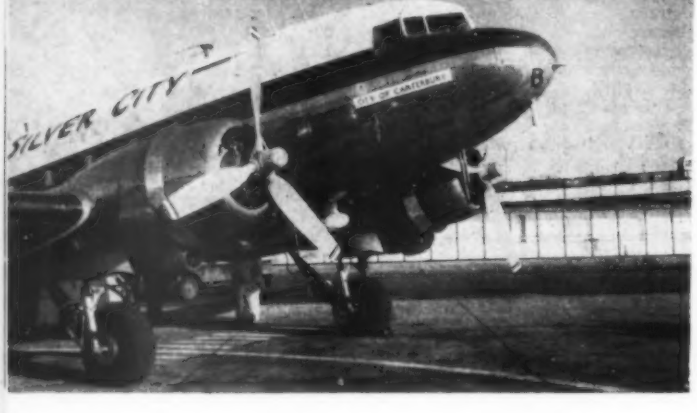
Apart from the initial contract, the terms of which will begin to be fulfilled this month when the aircraft starts its initial testing tour to Cyprus, Bahrein, Lagos, Kano and Accra, Silver City are offering their service to other governments. Twenty-nine countries in Europe, the Middle and Far East have so far been approached and the airline hope in this way to make the venture a profitable operation. A second operational-cum-demonstration tour, starting in February, will include a stop at Malta for initial calibration of a new VOR and another at Cairo for a demonstration.

Silver City argue that it is more economical for many civil aviation authorities to hire a calibration aircraft and trained crew at regular intervals (under ICAO standards an ILS must be checked every three months, other aids half-yearly) than it is to operate their own specially equipped machines at low utilizations.

Calibration measurements and recordings are obtained from special equipment installed in a modified Silver City DC-3, G-AOBN. Ten passenger seats remain in position, however, and Air Couriers' installation design allows for a fairly quick revision to passenger standard whenever it is required. Most of the radio equipment was supplied by the US firm of Wilcox, and the recorders came from Kelvin Hughes and test gear from Collins and Marconi. The complete—and very neat—installation of twin VOR and ILS test equipment was carried out by A. J. Whittemore at Biggin Hill.

A brief demonstration of ILS calibration at Gatwick gave an indication of the procedure that is followed in checking the width of the glide-path beam. A Decca Flight Log and visual observations are used to check the track, and pen recorders register departures from the centre line and plot time against distance over the ground. With the aircraft flying at a constant 1,000ft and at a steady airspeed, the second pilot registers a blip on the recording paper with a special button as the glide-path is entered and left, and the distance travelled related to the height then gives the beam width. Reduction of data by two electronic-aids technicians takes about one hour.

The aircraft is to be flown by Capt Rex Shilton, the Silver City pilot who was seconded to Handley Page for their overseas sales and demonstration tours with the Dart Herald.



Bristling with aerials, Silver City's recently converted radio-calibration DC-3 is shortly to embark on its first operation tour

Gradually all BEA's fleet of 63 Viscounts (including one on lease) are being painted in the stylish red, black and white "corporate image" colour-scheme introduced 18 months ago. Here is a new air-to-air of a Viscount thus painted—V.802 G-AOHL

AIR COMMERCE . . .

MR TATA'S COMMONWEALTH LECTURE

THE immense scope for the development of tourist traffic to India, at present limited to only about 100,000 visitors a year, was mentioned by Mr J. R. D. Tata, chairman of Air-India, in the Royal Aeronautical Society 16th British Commonwealth lecture that he gave in London on November 18. Entitled "The Story of Indian Air Transport" this well documented paper, by the man who *is* Indian air transport, can be regarded as the standard work on the subject.

Looking to the future, Mr Tata thought that the most serious likely obstacle in the way of Air-India's expansion might be the shortage of foreign exchange. But the airline was earning foreign money at the rate of more than £2m a year; and assuming that this difficulty would be overcome he could see no reason why Air-India's future growth would not at least keep pace with the rest of the industry. There was still considerable scope for enlarging Air-India's route system—"the Pacific is an obvious possibility"—and under its series of five-year plans India had embarked on a long range programme of forced expansion of its economy. As regards supersonics, "nothing should be done to discourage or deter such a phenomenal step forward," but—the qualification so often made by the leading men of international air transport—"it is fervently to be hoped that supersonic operations will not be forced upon the world of air transport for reasons of prestige or political rivalry between power blocs before all the technical and economic problems have been solved." In any case, in his view, supersonics "can only supplement and can never supersede subsonic aircraft."

AIR SAFARIS ACQUIRE DON EVERALL

IT was announced last week that Air Safaris Ltd and Don Everall Aviation Ltd have decided to merge their independent airline interests into one organization which will be known as Air Safaris Ltd. Don Everall Aviation, one of the smallest British independents, are based at Elmdon Airport, Birmingham, and operate scheduled services from the Midlands to the Isle of Wight, Exeter and the Channel Islands, and charter flights. Air Safaris are based at Gatwick and they operate no scheduled services but are active in the field of closed-group tours and general charters.

In effect, Air Safaris have acquired Don Everall's operating interests and the latter's share in the expanded Air Safaris will comprise their fleet of two Vikings and two DC-3s. Mr Everall will join Air Safaris' board and Don Everall Aviation's services from the Midlands, subject to Government approval, will continue to be based on Elmdon. Don Everall Aviation Ltd will continue to operate the airport at Wolverhampton and to overhaul aircraft under their own name; overhaul of Air Safaris' fleet of three Vikings and one Hermes will be undertaken as required.

Both Don Everall Aviation and Air Safaris have recently applied to the ATAC for new UK internal services; Don Everall for a Dakota and Viking daily service between Elmdon and Woolsington and Air Safaris for a Rapide or Dove service from Bournemouth to Plymouth and Culdrose. The former have also applied to increase their service from the Midlands to Guernsey and Jersey and to introduce new aircraft types, notably the Heron and the Herald. They have also applied to operate Viscounts on their Jersey services.

BREAKING-EVEN ON THE COMET

WHEN United Arab Airlines, then known as Misrair, last June took delivery of the first of three Comet 4Cs, the UK regional manager mentioned the possibility that a repeat order for three more 4Cs might in due course be placed. Last week it was reported that UAA have placed a repeat order for two more aircraft. A de Havilland spokesman confirms the airline has an option on a further two, but the taking up of these options is not yet the subject of a signed contract.

BEA also are planning to place yet another repeat order for Comets—the fourth since the original fleet of six Comet 4Bs was ordered. This, it is understood, would be for two further 4Bs, to bring the BEA fleet to twelve, or 16 including the four Olympic Airways aircraft operating in the BEA-Olympic consortium. No actual contract has yet been signed.

These orders, if confirmed, will bring the Comet order book to 60. Four years ago the managing director of de Havilland Aircraft, Mr (now Sir) Aubrey Burke, said that 50 Comet 4 series aircraft would have to be sold to break even (*Flight*, August 3, 1956, page 205). Making allowance for today's higher costs, it would appear that de Havilland are on the point of breaking even, if they have not done so already, on the Comet 4 programme.

Footnote: In last week's special Commercial Aircraft issue weights and tankage of the Comet 4C (page 798) were inadvertently quoted "as Comet 4B." This was intended to read "as Comet 4"; in fact the 4C's max weight is 162,000lb, ZFW, 102,500lb; capacity payload (weight limited), 23,145lb; less fuel and payload, 79,355lb; and its tankage is 8,908 Imp gal.

BREVITIES

According to the FAA the number of civil aircraft registered in the United States is now nearly 80,000 compared with 70,747 on January 1. Of these 2,020 are in airline service and there are 6,034 multi-engined aircraft and 27,259 single-engined aircraft with at least four seats in the general aviation category. Apart from this there are 35,334 other types.

The contractors for the new Karachi runway, Vinnell Corp, Alhambra, USA, have selected the GEC company's lighting system. Cost will be £82,500. The new 10,500ft runway, with 1,000ft stopways at each end, is being built to the north of the old one and is scheduled to be in operation on February 1 next.

Air France last week announced a repeat order for three Boeing 707-320s for delivery in the spring of 1962. This will bring to 20 the airline's Boeing jet fleet, and the Boeing order book for 707 and 720 series aircraft is now 257. Stop press: it is reported that American, Pan American and TWA have all logged more than 100,000 hours (revenue and non-revenue) with 707s.

At A. V. Roe last week inspecting the Avro 748 was Mr Sao Wunna, cabinet member of the Burmese Government and a past chairman of Union of Burma Airways. With him is Mr Emanuel Golitzine, Avro's sales manager

Capital Airlines have sold five of their Viscount 745Ds to Alitalia. They have been converted and painted at Washington to Alitalia's standards, and will replace Convairs on Italian domestic routes.

It is reported that a river hovercraft is being developed by the Ministry of the River Fleet of the USSR, together with a hydrofoil craft capable of carrying a 200-ton payload.

Re-elected Master of the Guild of Air Pilots and Air Navigators for 1960-61 is Dr Kenneth G. Bergin. Mr A. M. A. Majendie has been elected a Warden, the other wardens being: Mr E. B. Trubshaw, Capt J. T. Percy, Capt M. R. Aries and Capt B. C. Frost.

It is understood that the Ministry of Aviation is seeking Treasury approval for the completion of the second runway at Gatwick Airport in time for the 1962 summer season. Cost, according to one report, would be £3m in addition to the £7m approximately already spent on the airport.

The first two BEA V.951 Vanguards are due to be delivered to the corporation during the first week of December, and BEA's date for introducing the type into initial passenger service is December 20. Full Vanguard schedules, as already reported, are planned to begin on March 1.

Representatives of the London Airport local authorities committee are, says a Ministry of Aviation statement, "concerned about the continued rise in aircraft noise, particularly at night." At a recent meeting with Mr Geoffrey Rippon, Parliamentary Secretary to the MoA, a "full and frank exchange of views" took place, and Mr Rippon assured the committee that the Minister "would continue to do all he could to keep noise levels down." He recognized the claims of hospitals and schools for special consideration, and said that research is being "actively pursued in an effort to obtain more adequate solutions."

A D.H.C. Caribou of the Royal Canadian Air Force, one of the type now in service with RCAF Transport Command in Egypt as part of Canada's contribution to the UN Emergency Force

SERVICE AVIATION

Air Force, Naval and Army Flying News

Rhodesian Visitor

TODAY the Chief of the Air Staff, Royal Rhodesian Air Force, AVM E. W. S. Jacklin, was due to leave by Comet for RAF Germany after a week's round of visits to the Royal Air Force in the UK. This began with a luncheon at Fighter Command headquarters last Monday, when AVM Jacklin was presented by the CAS, Air Chief Marshal Sir Thomas Pike, with a silver cup, subscribed for by all eight home commands of the RAF, symbolising the bonds existing between the Royal Air Force and the Rhodesian Air Force.

UK-Aden: 7hr 10min

AN unofficial record for a flight from England to Aden has been set up by a Vickers Valiant of No 214 Sqn. Taking-off at 0300hr on November 16 from the squadron's base at Marham in Norfolk, the aircraft landed at Khormaksar at 1010hr, having covered 4,030 miles in 7hr 10min at an average speed of 565 m.p.h. It was air-refuelled over Idris, Libya, by a tanker Valiant from the same squadron.

The previous fastest time for an England - Aden flight was set up by a Vulcan which on September 9, 1956, covered the distance from Boscombe Down to Khormaksar (3,940 miles) in 7hr 23min at an average speed of 530 m.p.h.

The Valiant, whose flight was 90 miles longer than that of the Vulcan, was captained by Sqn Ldr John Garstin. He was also in command of a Valiant which in March this year made the longest-ever flight by a Royal Air Force machine, 8,500 miles non-stop round the UK. Then in May he captained the Valiant which flew non-stop to Singapore, setting up another unofficial record for a flight of 8,110 miles in 15½hr.

Sqn Ldr D. B. Barfoot, CO of No 249 Sqn, receiving from Air Marshal Sir William MacDonald, AOC-in-C Middle East Air Force, the Sassoon Trophy won by the squadron in the annual competition between units of the MEAF Light Bomber Wing. Runners-up were No 32 Sqn and third place went to No 73 Sqn

Robertson Trophy Winners

AT the Air Public Relations Association annual reunion at the RAF Club last night the C. P. Robertson Memorial Trophy was being presented to Sqn Ldr Peter Latham who commands Treble One Sqn. The trophy is awarded annually for "the best interpretation of the Royal Air Force to the public" during the preceding 12 months, and in this award aptly commemorates the consistently brilliant performances put on by the squadron's black Hunters at air displays in Britain and on the Continent. Sqn Ldr Latham has led the team, official representatives of Fighter Command, since becoming CO last year.

RAF/AAC Aircraft

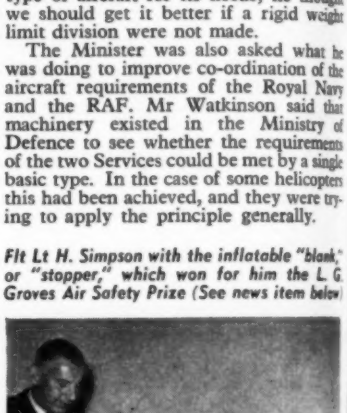
WHEN asked in the House of Commons last week whether he was satisfied with the weight limit of responsibility between the Army and the RAF for aircraft operation, "in view of the development of steep-take-off aircraft," the Minister of Defence, Mr Harold Watkinson, said that as his predecessor indicated in his answer on June 3 last year, the weight limit was not rigidly interpreted.

His questioner, Mr Geoffrey de Freitas, went on to ask whether there was not a grave danger that as the limit had been set when conventional aircraft were being considered, however vaguely the definition was interpreted, the Army would be encouraged to rely on obsolete aircraft, in spite of new developments, to keep safely on the side of the division.

Mr Watkinson said that he did not think so, and that was why he did not want to make a rigid division. He was anxious that the Army should have the right modern type of aircraft for its needs; he thought we should get it better if a rigid weight limit division were not made.

The Minister was also asked what he was doing to improve co-ordination of the aircraft requirements of the Royal Navy and the RAF. Mr Watkinson said that machinery existed in the Ministry of Defence to see whether the requirements of the two Services could be met by a single basic type. In the case of some helicopters this had been achieved, and they were trying to apply the principle generally.

Flt Lt H. Simpson with the inflatable "blank," or "stopper," which won for him the L. G. Groves Air Safety Prize (See news item below)



IN BRIEF

AVM A. C. Kermode, Director of Educational Services at Air Ministry, is retiring from the RAF.

Mr Julian Amery paid his first visit to a Royal Air Force command headquarters since his appointment as Air Minister when he went to Bomber Command HQ at High Wycombe, Bucks, last Friday. He was received by the AOC-in-C, Air Marshal Sir Kenneth Cross, and given a presentation on the role of the Command.

Westland Whirlwind helicopters of "C" Flight, No 22 (Search and Rescue) Sqn, based at RAF Valley, Anglesey, have been operating a regular mail service to the Skerries lighthouse, landing on a flat rock 10yd square. The flight is one of three detachments operated by No 22 Sqn, which is based at St Mawgan and recently received a squadron standard (this page, October 28).

Two RAF men from the staging post at Gan in the Indian Ocean, WO S. W. Bushell and Cpl K. Bayliss, have supervised the construction of an airstrip on a coral island, Hulele, in the Male Atoll, Maldive Islands. With the help of 200 native labourers, the site was cleared and a 3,000ft long, 50ft wide PSP runway laid in four months. The strip is to be used to provide air transport facilities for Maldive Government officials and the UK Government representative at Gan, 300 miles away.

The Chief of the Defence Staff, Admiral of the Fleet the Earl Mountbatten of Burma, and the Chief of the Air Staff, Air Chief Marshal Sir Thomas Pike, were among the guests at the RAF Reserves Club annual dinner, held in London on November 14. The club's president, Sir Miles Thomas, presided.

Among the L. G. Groves memorial prizes and awards presented at the Air Ministry last Friday was the £50 Air Safety Prize which went to Flt Lt H. Simpson, an engineer officer now stationed at RAF Feltwell, for his design of an "inflatable stopper" type of air intake cover to prevent foreign matter getting into the engines of V-bombers on the ground.

The Australian Minister for Air, Mr F. M. Osborne, recently announced a scheme to raise the training standard for RAAF officers to university degree level. Under it, from 1961 onwards, RAAF cadets are to graduate with BSc degrees from Melbourne University and Point Cook Training College would be re-constituted as the Royal Australian Air Force Academy.

Rocketdyne Round-up

PART 2 OF THE SIR HENRY ROYCE LECTURE

LAST week we published the first part of our precis of the 1960 Sir Henry Royce Memorial Lecture, read before the Derby branch of the Royal Aeronautical Society on November 7. The author was Mr S. K. Hoffman, president of the Rocketdyne Division of North American Aviation Inc, whose large liquid-propellant engines power most of the West's strategic ballistic missiles and space boosters. In his conclusion Mr Hoffman touches upon many fields of engineering development and outlines his company's plans for the future.

Engine simplification The rapid development schedules required for most current engines often preclude the luxury of attempting novel schemes. A series of experimental engines is used for the sole purpose of testing previously untried innovations, which are tested in these engines and tested as they are conceived. In early engines much of the complexity was caused by the starting and control techniques. Power to start the turbopump was supplied by a set of pressurized oxidizer and fuel tanks which fed the gas generator. Operation of the valves was provided by means of an electrical interlock system which controlled pneumatic actuators in the proper sequence. Igniters were used in the gas generator and thrust chamber to provide an ignition source for propellants. A pressurized oil tank was used to provide turbopump lubrication.

Turbopump initial power is now provided by a solid-propellant starter or by tank head. Propellant valves are actuated by fuel bled downstream of the turbopump discharge, and springs in the valve actuators are preset to open at a given point during the pressure buildup, in what is called the pressure-ladder sequence, without recourse to any electric or pneumatic system. Ignition of the gas-generator propellants is accomplished from the turbine starter, or by a simple spark plug for tank-head start. Ignition in the thrust chamber is initiated by a slug of hypergolic propellant injected prior to entry of main fuel. Turbopump lubrication is accomplished by diluted fuel. A tapoff system offers the possibility of eliminating the entire gas-generator system. Combustion gases are merely bled from the thrust chamber and used to drive the turbine.

A pyrotechnic squib, used to close the main lox valve, permits the elimination of the vernier engine. The surges which result from the rapid valve closure are relieved by a burst diaphragm and by-pass line. Roll control may be achieved by a swivel nozzle on the turbine exhaust duct. These trends in turn have led to simplification of the required servo loops; previously, propellant sequencing and subsequent control functions were separated; now they are combined in one valve. Another advantage has been minimization of engine checkout prior to launch. Expensive equipment for turbopump lubrication, component servicing, jacket prefill, engine flushout and purging, electrical system and external hydraulic supply, has been reduced or eliminated.

Fabrication Rocketdyne has evolved basic techniques for manufacturing engines which have proved to be versatile and readily adaptable to all design configurations. Early engines pioneered tubular-wall chambers. The tubes are placed on a mandrel, held by steel bands, and brazed to form a gas seal. Hydraulic tube forming is commonly utilized, and allows considerable design versatility. To minimize chamber weight and simplify construction, a resin-impregnated fibreglass wrapping technique has been developed. Thrust chambers have withstood repeated firings with no deterioration of this coating by heat or chemicals. Another area of advance is the tube-brazing operation. Previously accomplished manually, by skilled operators, an inert-atmosphere furnace technique has been developed which cuts brazing time for Atlas and Thor chambers from 365 to 6 hr. The technique offers definite advantages in fabrication of extremely large chambers, where stainless of Inconel tubes do not lend themselves to hand-brazing.

Such components as injectors, turbopumps and gas generators, require particular accuracy and close tolerances. Numerically controlled equipment results in more accurate duplication, and is in use for drilling, milling, and inspection. Torque-sensing devices are used for drilling special materials such as René 41. Under conditions of non-uniform torque, speed, or feed pressure, this metal develops local hot spots, which become heat-treated.

H-1 engine In 1958, a cluster of eight 188,000lb H-1 engines was adopted for the Saturn booster stage. Although requiring more engine units, a reliable cluster could be available sooner and would cost less than any other system. The H-1 is an outgrowth of the IRBM systems, gimballing of the entire package being facilitated through flex lines in the low-pressure ducts connecting the vehicle tanks to the turbopump inlets. The highest thrust currently achieved with storable propellant combinations has been with the E-1 thrust-chamber assembly (N_2O/UDMH at 300,000lb).

F-1 engine The F-1, designed to produce 1,500,000lb thrust, is the largest single-chamber engine known to be under development. A contract to design and develop this engine system was received from the National Aeronautics and Space Administration in January 1959. In August 1959, mainstage testing demonstrated stable combustion, and many start and mainstage tests have since been conducted. The engine is designed for operation with liquid oxygen/kerosine propellants, employs a conventional bell-shaped tubular-wall nozzle and a turbopump side-mounted on the thrust chamber, and the entire unit can be gimballed. In a single-engine application, it will provide the maximum performance and ultimate reliability for a second-generation booster. In a clustered application, it fulfills the need for a highly reliable clusterable engine. The engines in the cluster are connected only through electrical impulses that control startup and shutdown.

E-1 engine In 1956 the first 300,000lb chamber was built and tested, and in late 1958 the first E-1 engine was assembled and subsequently fired. Later efforts on the engine have included tests in the 400,000 to 500,000lb class.

J-2 engine Early in 1959, several engine and vehicle manufacturers were asked by NASA to investigate the design requirements for an upper-stage engine system, based on lox/kerosine boosters having thrusts of 1,500,000 and 6,000,000lb. The results indicated that a lox/liquid-hydrogen engine in the second stage would put up to 80 per cent more payload in an Earth orbit. On June 1, 1960, NASA contracted for a 200,000lb-class lox/liquid hydrogen system, for first use in a Saturn upper stage. This J-2 engine system is designed for high-altitude operation; the engine features advanced concepts already tested and proven, and thrust-chamber tests have demonstrated high propellant performance and stable combustion. The J-2 development programme is directed toward completion of preliminary flight rating tests and qualification by the mid-1960s.

The next decade Advanced systems utilizing lox/kerosine for booster engines and high-energy lox/liquid hydrogen for upper-stages, will be the workhorse systems for space flight in the coming years. A high-thrust, liquid-propellant rocket with a high performance potential is the nuclear engine. A specially designed reactor heats a single propellant to a high-temperature gaseous state. A low molecular weight propellant results in a high exhaust velocity. The maximum specific impulse obtainable with chemical propellants is somewhat greater than 400sec; with nuclear systems, values two to three times greater are possible. The use of the nuclear engine in an upper stage eliminates the operation of the "hot" reactor at the launch facility. The Saturn with a nuclear third stage (replacing the J-2) single can soft-land a 14,000lb payload on the moon, compared to 6,000lb with the J-2. The use of hydrogen propellant in space has been thoroughly investigated, and the storage of hydrogen in a space stage for an extended time is feasible through the use of multilayered reflective radiation shields.

In August 1957, Rocketdyne was awarded a contract for the test nozzle for use in the Kiwi-A, the first reactor designed to study the feasibility of nuclear rocket propulsion. The reactor, developed by the Los Alamos Scientific Laboratory, and the nozzle were successfully tested at the Nevada Test Site in July 1959. In addition, substantial progress in the design of nuclear-engine components has been accomplished. Extensive work on nuclear-engine systems has now provided a wide background of technical information. Design concepts investigated have proved to be practical and applicable to a flyable engine design. Although additional work is required, nuclear-engine technology is at the point where development of a safe, reliable unit can begin. It is clear that in the next decade it will be developed to provide the power and performance required for our advanced flights into space.

THE CANADIAN INDUSTRY

SPEAKING about the Canadian aircraft industry in his report to the IATA meeting at Quebec the president of the Air Industries and Transport Association, Mr F. T. Wood, said that it was imperative that the Federal Government should recognise its needs and assist its development. Gross sales last year were $135m less than in 1958 and 15,000 fewer men were employed; further decreases could be assumed for 1960. The export market alone could not prove a means of salvation, since every country was facing a reduction in the production of military aircraft.

Mr Wood suggested that the industry might profitably make a gradual shift in emphasis towards the military role. Such a move would be consistent with foreign policy and would increase Canada's prestige.

Taking the high and the low road across Loch Lomond are a "giroboat" built by General Development Co (Glasgow) Ltd and a 35 h.p. Perkins-powered motor boat. Towing speed is 30-35kt; take-off run for the giroboat is 100yd and its cost is £160-£200

Sport and Business

THE 1961 NATIONAL GLIDING CHAMPIONSHIPS will be held at Lasham Aerodrome from Saturday, May 13, to Monday, May 22. For the first time in recent years the number of entries may have to be restricted, although this has not yet been decided. As in previous nationals there will be two leagues: sailplanes in League 1 will not be handicapped, while those in League 2 will be handicapped. Once again an international glider trade fair will be held in conjunction with the championships.

ILLUSTRATED BELOW is the four-seat fuselage of the new Procaer Cobra executive aircraft powered by a Turboméca Marboré II turbojet giving 850lb thrust. The first prototype, a two/three-seater, is now undergoing testing. The engine is mounted in the fuselage immediately aft of the wing, with bifurcated wing-root intakes; and the thrust line is tilted downwards to allow exhaust to clear the fuselage skin. The Cobra is intended for a maximum level speed in the region of 380 m.p.h. at heights up to 20,000ft, the occupants using oxygen. Pressurization might prove possible at a later stage.

Like the four-seat, piston-engined Picchio, several of which have now been delivered to customers, the Cobra has a wooden airframe with plywood skinning covered with thin aluminium sheets Redux-bonded to the wood. The finish is extremely clean and more durable than plain wood. The Picchio has a 1½mm ply skin sheathed with ¼mm aluminium. This weighs about the same as a 2mm ply skin to which it is equal in shear strength. The Cobra has 2½mm ply skin covered with aluminium.

Considerable testing has been done with this type of skin both in the form of test panels and complete airframe components. Trade secrecy is being maintained on the finer points of strength and detail design. The only information readily obtainable is the fact that the relative thicknesses of the two materials are arranged so that both rupture simultaneously. Apart from the aspect of durability, there seems to be little to suggest that the ply-metal skin is superior to ordinary plywood. The reduced thickness and consequently reduced inertia of the panels would appear to make it an inferior structural material for end-loaded skin panels. But the very much higher Young's Modulus of the aluminium alloy compared with plywood will increase the buckling load. Also the higher tensile strength of the metal is a useful asset on the lower wing surface. Comparison between the weights of the Nibbio and Picchio show that there is a very slight weight advantage to be gained.

Designer Stelio Frati, responsible for the earlier Rondone, Falco and Nibbio, has now projected a six-seater with approximately the same dimensions as the Twin Bonanza and powered by two turbojets. This would have an all-metal airframe.

FOURTEEN of the original 20 Drovers designed and built by de Havilland in Australia are still operating. Six are with the Royal Flying Doctor Service, three are flying in Fiji with Fiji Airways, one is in New Guinea (where it has been operated by Qantas and may be taken over by TAA), two are operated by the Commonwealth Department of Health in Northern Australia, and two are based at Bankstown, near Sydney, with private operators.

The Drover was designed by the late Martin Warner to solve the post-war problems of the Australian bush operator, and was particularly aimed at feeder airlines. With three engines (Gipsy 10 Mark 2), it offered good engine-out performance and was ruggedly built for outback operations. At £14,000, it was a cheap aircraft. As Australia's first—and still her only—airliner, the Drover gained considerable prestige for the Australian DH organization. But there were troubles—the original de Havilland variable-pitch propeller had to give way to Fairey fixed-pitch propellers, after what our Australian correspondent describes as some hairy incidents. Double-slotted flaps were installed at the same time. These changes made the Drover a dependable aircraft which was of some credit to Australia. Its main drawback, which is serious in Northern Australia, was loss of performance at altitude in hot weather. Between 1947 and 1953, twenty Drovers were built.

Three years ago, the Flying Doctor Service looked about for a Drover replacement and was strongly pressed by the US industry with modern twin-engined types. Meanwhile, after looking over available engines abroad, de Havilland came up with a proposal to re-engine the Drover. Much to everybody's surprise, this proposal beat the foreign competition.

Six Drovers are now being re-engined, at least one is now flying, and the job will be finished within 12 months. The 180 h.p. Lycoming O-360-A1A has been installed, together with Hartzell controllable-pitch, feathering propellers. The whole powerplant installation has been re-designed, with fibreglass being used extensively in the cowls. Some other airframe modifications were also carried out, mostly connected with flap actuation and tailwheel energy-absorption capacity. A new cooling system using ejector exhausts has proved adequate, even when ambient ground temperature was 109° during tests, and has been cleared for 113°.

The new Drover is an attractive aircraft. Cruising speed is increased by 25 m.p.h. to 145 m.p.h. One-engine-out rate of climb at sea level is now 430ft/min, while engine-out ceiling is 9,000ft, max climb 1,040ft/min and max ceiling 20,000ft. With 132 gallons of fuel, range is 900 miles. All-up weight is the same as before, 6,500lb, with the same payload. It is understood that the cost of the re-engine work and other modifications is about £14,000.

RETROSPECT

From "Flight" of November 26, 1910

A Flying "Circus": From America the first "Aviation Circus" is reported as having been formed, the programme opening with the following illuminating information: "This circus has enrolled the greatest, grandest, and speediest aggregation of aerial chauffeurs in the world, and in death-defying, dare-devil races through the air they will give the public thrilling value for their money."

It is to be hoped that the "aerial chauffeurs"—said to be Moisant, Charles Hamilton, Roland Garros, Rene Simon, E. Audemars and J. Frisbje—will take a different view of their responsibility to themselves and the public than the compilers of such blatant stuff have in mind. This "circus," which comprises 20 biplanes and monoplanes, and has its own equipment of tents, motorcars, trucks and horses, opens at Richmond, Virginia, today (Saturday). After touring the United States, it is intended to exploit Europe.

Four-seat version of the Marboré-powered Procaer Cobra takes shape at Milan (see news item above). The ply skinning is aluminium-covered

Lycoming-powered Drover operated by the New South Wales branch of the Royal Flying Doctor Service and described in the above news item

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

The Munich Accident

I HAVE no wish to enter into any kind of public conflict with Captain Key through the columns of *Flight* or elsewhere on the subject of the Munich accident, but his letter published in your issue of November 18 cannot be allowed to pass without comment.

Capt Key has been given every opportunity of criticizing BALPA both from inside or outside the Association for the part it has played in investigating the causes and circumstances of the accident, and the Association has replied to those criticisms. No body or organization is perfect, but the Association in the ultimate has no cause to be ashamed of what it has done either on behalf of Capt Thain or in the wider interests of air safety as a result of its investigation into the accident. Certainly at no time has it approached its task on the basis that Capt Thain must be guiltless on all counts because he is a member of BALPA. Capt Key complains that the Association has not conducted an objective investigation into the accident. This has been done, and the objective evaluation carried out by the Fay Commission did not vary so greatly in its general conclusions from those reached by BALPA, which, in my view, has fully justified the Association's position in pressing for a fresh inquiry into the causes of this accident.

Capt Key's statement that BALPA has denied that Capt Thain was in error is misleading and mischievous. The Association in fact made no comment upon his actions prior to the final attempted take-off as it considered that this matter was *sub judice* until such time as the Minister had made a final decision as to Capt Thain's compliance with the regulations. When the Reviewing Body published its report BALPA accepted those findings and did not attempt to offer any mitigating circumstances.

BALPA has been criticized before, but, I contend, never with less justification. I believe that Capt Key's criticism of the Association is incompatible with the facts, either in its role of a professional body seeking to advance the standards of safety in aviation or in that of a trade union supporting a member in a difficult situation and fighting against heavy odds to retain his means of livelihood. More strongly do I resent the implication that BALPA has acted without integrity in this matter. I do not seek to discover Capt Key's motive in calling BALPA into disrepute, and by the same token I do not recognize his right to imply motives to the actions of this Association which are, to say the least, unworthy.

Harlington, Middx (Captain) D. F. O'SULLIVAN,
Chairman of the Central Board,
British Air Line Pilots' Association

The First Night Flight

I WAS bound to find Mr Gibbs-Smith's letter [October 28] interesting. I think it would be advantageous if he would be good enough to provide proof for the assertion that although the signature is that of Henri Farman, the text was in the handwriting of another.

I do not seem to have ever questioned the whole, myself; and in view of his statement that Farman could speak next to no English at that time, I feel that that cannot be substantiated by Mr Gibbs-Smith.

Now I knew all the three Farman brothers, Henri, Dick and Maurice, and I was much in Henri's company prior to the London - Manchester flight. When he came over to help Claude Grahame-White for the first flight from Park Royal, I escorted him to various places, including buying ties and shirts at Mr Wing's of Piccadilly. Not because Farman could not speak English but because time was precious and I could streamline his itinerary.

I recollect Henri Farman as a serious, reserved man, reticent of speech, no orator; when he spoke either in French or English it was rapid, tending to indistinctness, derived from one or two circumstances. One, he constantly had a cigarette drooping from his lips, and he made little movement of his lips when speaking. His working action and his general change of poise was, like his speech, rapid, rather like quicksilver. In retrospect one is reminded of the sharpness of a ferret.

I had hoped to check better on Mr Gibbs-Smith's statement by referring to documentary evidence, but alas the years have resulted in masses of written matter getting submerged. However, although it is true Dick was the commercial or office man, I had much correspondence with Henri, even after the war, on the subject of aviation insurance. And his letters were lengthy and handwritten. Working from Paris, I had a monopoly of all the aviation insurance in the whole of Europe at that time.

Through Lloyds I used to insure the flights of his machines and his pilots when regular commercial routes were being opened up to Tunis and Rabat and Dakar, apart from the metropolitan flights and pleasure flips for enthusiasts.

Some of your readers may find it interesting to learn that I was the originator of aviation insurance. It occurred as a result of the first article ever written on the subject, in *Aeronautics* in 1911 or 1912, by me. A syndicate of Lloyds got interested.

The result was that soon I was insuring practically everyone in English aviation. Out of this arose a very anomalous situation. The first claim the underwriters had was from a Frenchman we had insured, Salmet I think, who crashed in Edgbaston Reservoir. The underwriters wanted financial details of the loss. As there were no qualified assessors for aircraft in those days, they sent me to Birmingham to make the estimate. This of course cut quite across the etiquette that there must be no chance of collusion between the agent getting the insurance and the settlement of claims!

Here I can disclose something that I do not doubt has been forgotten.

H. Barber, the fanatical enthusiast of his "Valkyrie" machine, had reconciled himself to defeat after C. G-W. refused to allow him to fly at the Parliamentary Air Display at Hendon (Barber's machine was notoriously unstable); and Barber, who in spite of his heavy financial losses in constructing, was still a wealthy man, became head of a syndicate on Lloyds. And it was his syndicate that took on the aviation insurance.

Polperro, Cornwall F. NETTLEINGHAME

Chichester's Tasman Flight

IN your report (November 11) of that memorable evening when the Royal Aero Club honoured Francis Chichester for his winning the transatlantic solo yacht race you recalled amongst his notable feats of air navigation the first flight from New Zealand to Australia. I wonder whether many of those present were able to recollect exactly what lay behind this bare statement of fact?

When Francis Chichester proposed to fly a Gipsy Moth across the Tasman Sea in three hops of approximately 500 miles in 1931, making his refuelling stops at two little dots, Norfolk and Lord Howe Islands, he intended to navigate by sextant. All the experts agreed that such a method, for a solo aviator, would be impossible. There was no radio and if Chichester had failed to pin-point either of these islands, on each successive occasion he would never have survived in the treacherous waves of the Tasman. To make matters more difficult, he had to fly a seaplane (which can be tricky to handle alone on the water and has a habit of getting wrecked at its moorings), because there were no landing strips.

Confounding all the experts, Chichester used his sextant to find Norfolk Island and then went on to find Lord Howe Island, too. This double performance rules out the element of fluke, beginner's luck or anything other than a degree of navigational skill which to my knowledge has never before or since been equalled, or even attempted, by a solo aviator.

This trans-Tasman flight did not hit the headlines in a big way, because it was done in an unspectacular manner (en route repairs taking some weeks), and happened in an era when dashes across the Atlantic or halfway round the globe were far better box-office. Perhaps at this length of time, it may be easier to weigh up the true value of this accomplishment. To my mind, by all the standards of skill in the art of aviation, Chichester's flight from New Zealand to Australia is the most outstanding solo flight ever made.

London W1 JOHN GRIERSON

Bacon v. the Historians

MAY I be allowed to take issue with Roger Bacon in his "Straight and Level" dated October 28, in which he makes a rather childish dig at what he is pleased to call "the historical nitpickers."

Considering the fact that his whole column is devoted to *modern* nitpicking, I fail to see what his objections are to those UNPAID students of air history whose only object is ACCURACY. Is it unreasonable to expect that any so-called factual programmes produced for public consumption *should* be accurate? Especially when the vast majority of the mistakes made in such programmes are fairly easily avoidable with the present available sources of information. I feel sure that I am not alone in feeling fed-up with the number of so-called "new" accounts of various facets of aviation history which are still being produced, and which, on reading or watching, prove to be merely re-hashes of old information containing "boobs" left, right and centre.

Roger Bacon states that he is "grateful for the fact that the BBC has devoted so much peak viewing time to aviation." This statement conjures up a vision of a well-satisfied R.B. viewing some of the atrocious American films produced during the 1939-1945 war purporting to be based on fact, such as "Eagle Squadron" and worse; and feeling humbly grateful for the fact that the BBC deigned to nod at the importance of *any* air history being worthy of the public eye.

Please bear in mind, Mr Bacon, that the only reason that there are ANY factual accounts of aviation history is due to the number

CORRESPONDENCE . . .

of amateur "nitpickers" throughout the years who were not satisfied with accepting any old rubbish presented as fact, but preferred to keep digging until the truth was discovered. Therefore, it hardly becomes the would-be aerial Nat Gubbins to deride their efforts to establish a worthy standard.

Calshot, Southampton — R. BOWYER

I HAVE been receiving *Flight* continuously since the age of eight (14 years ago) and have welcomed it especially as a means of revealing the aeronautical history of those fascinating years before my time. Experience has taught that it can be treated pretty implicitly—which is more, it seems, than can be said for the BBC.

To select a single instance from *The Flying Years*. The number of young people, for example, who, seeing a Gloster E.28/39 for the first time, are now happily exchanging the information that our first jet aircraft was the Gloster E.29, is maddening to contemplate. And was there any justification for tacitly passing off a Sabre as an E.28/39?

The attitude of "G. Doorpost" (*Flight*, Nov. 4) I find hard to support. He appears content to endure inaccuracies in a production allegedly designed to tell us about the development of British aviation.

If accurate data are to be handed on from one generation to the next it is essential that those with specialized knowledge do not allow fallacies and careless blunders to be perpetrated without corrective comment—preferably in the columns of *Flight*.

Small errors often lead to bigger. Take the thing a bit further and we shall be learning of the Wright brothers' Russian parentage or (further still) the triumph of Harold at Hastings.

Droitwich, Worcs — BRYAN W. WILKES

IT would seem from your issue of November 4 that the correspondence relating to the recent series of BBC programmes under this title has reached a surprisingly low level in poking fun at the "historical perfectionists."

Let us at least try to be fair in this matter. Perhaps the discussion of some of the more minor details of aviation history can be a little boring at times but here we are considering a major television production backed by the reputation of the BBC, introduced by a leading figure in British aviation and quoting an impressive list of sources from which, one would assume, historical information was derived. Surely it is not too much to expect the highest standard of historical accuracy under these circumstances?

The fact that such a standard was not attained, coupled with the poor co-ordination between commentary and films, resulted in the programmes being a distinct disappointment—despite the undoubted appeal of the early films—to many people other than historical perfectionists, or "nitpickers" as I believe Roger Bacon described them.

With reference to Roger Bacon in this context, I must confess that I find it rather hard to reconcile his passion for accuracy concerning the armament of historic aircraft (your issues dated July 22 and July 29, 1960) with his magnanimous "who cares" attitude towards *The Flying Years*. By all means let us hope that the BBC will devote more peak viewing time to matters aeronautical; but, if so, let us also hope that they will take the trouble to do the job properly.

Welwyn Garden City, Herts — DAVID B. BROWN

Light Aircraft Engines

I AM writing to deplore the necessity for us to import the American Continental aero-engine for light aircraft, since we led the world in the production of light aircraft and engines after the First World War. The pretext that there are no suitable aero-engines of British design for this purpose hardly holds water, and even if this were the case, whose fault is it but the Government's, who have repeatedly discouraged our own designers from producing such engines over the years—myself included? The so-called Monaco engine was in advance of the American engines in many respects, but due to Government discouragement, in so far as private flying was concerned, its production of this was never proceeded with, and so the enterprise was still-born.

Fortunately I have now obtained possession of the drawings through the kindness of Lord Brabazon, who returned them to me on the death of Mr Peter Monkhouse, managing director of Monaco Engines. It should not be too difficult to bring these up to date in a very short time if someone has the enterprise to get interested.

It would be a crying shame if the technical ability and enterprise of our aero-engine designers were allowed to be frustrated indefinitely.

St Albans, Herts — H. R. MAYES (late chief engineer and chief designer, Monaco Engines)

"The Trial of Francis Powers"

HAVING just received a copy of *Flight*, dated October 28, in which you print an unsigned communication entitled "The Trial of Francis Powers" (Correspondence, page 680), may I say that some effort was made in the United States to market this quite unspeakably awful piece of doggerel but it was, I am told, a failure.

A large number of Americans did not share the sentiments expressed by "Red River Dave."

N.Y. — NEW YORKER

CORRESPONDENCE IN BRIEF

In *Flight* of September 2 we published a letter from Mr Harold Solomon, of Bristol, who was wondering how best to dispose of a collection of aeronautical historical material. He now writes to say that the letter brought such an overwhelming response that he has not been able to reply to all those who wrote to him; he hopes, however, to do so ultimately.

THE INDUSTRY

Mr P. L. Stride, formerly manager of the Malmesbury works of Ekco Electronics Ltd, has become manager of the company's aviation division.

Mr A. A. Taylor, ACA, has been appointed company secretary of Sterling Metals Ltd in succession to the late Mr T. Barker. Mr Taylor was formerly chief accountant.

An illustrated 52-page brochure describing the range of UK-AN connectors is available from the Plessey Co Ltd (Wiring and Connectors Division), Cheney Manor, Swindon, Wilts.

Pilots of No 111 Sqn, which until recently provided the RAF Fighter Command official aerobatic team, visited the Hereford works of Henry Wiggin & Co Ltd on November 11.

Saunders Valve Co Ltd have announced that while remaining joint managing director with Mr A. L. Trump, Mr P. T. Stephens has been appointed deputy chairman. Mr P. C. E. Rose, an executive director, has been made general manager of the company's industrial divisions.

Desoutter Bros (Holdings) Ltd have announced the formation of a subsidiary, Carter Stevens (Automation) Ltd, to carry on the businesses of Carter Stevens & Co (Engineering), Carter Stevens & Co (Automation) and Blakeman Designs, all of Coventry.

Two new publications by Negretti & Zambra Ltd, 122 Regent Street, London W1, are a brochure, C100, describing the contract engineering facilities provided by the company, and an Australian version of the general catalogue (F25/AI.1960) which is being widely distributed by Negretti & Zambra (Australasia) Pty Ltd.

Sherwood Studios, producers of technical publications, have moved to larger premises at 15 High Street, Camberley, Surrey.

A hydrogen peroxide data manual, illustrated both diagrammatically and photographically, has been published by Laporte Chemicals Ltd, Luton, Beds.

The aeronautical division of Marconi's Wireless Telegraph Co Ltd is now being regrouped in new premises at Basildon, Essex, where the bulk of the company's aeronautical equipment is manufactured. Full address of the division is now Marconi's Wireless Telegraph Co Ltd, Aeronautical Division, Christopher Martin Road, Basildon, Essex (Basildon 22822).

Mr C. J. Strother (left) and Mr B. N. MacLarty, engineer-in-chief, Marconi's, who were the first Marconi staff at Croydon and did the first radio installation in a civil passenger-carrying aircraft, at an informal party held recently to mark the closure of the Marconi depot at Croydon Airport after more than forty years. Among others who attended were Sir Noel Ashbridge, a director of the company, and Mr F. S. Mockford, the commercial manager

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